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Automatic Lacquering, Enameling and Japanning

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New York.

Can be Done Better and More Cheaply Than by Spray, Brush, or Hand Dipping.

LACQUERS, varnishes, enamels, paints, japans and other organic coverings to protect underneath finishes and in many cases to improve the appearance of the finished article are not always easily and properly applied.

It is evident that the most positive way to cover the entire surface, crevices, angles, contours, etc., of irregular shapes or complicated designs is to dip or immerse the article in the protective covering. When this is done we are quite sure that it is entirely covered.

This method has been used for years but is generally done by hand. It is slow and costly and the drip, sag, or run is in many cases objectionable.

Equipment

Some progressive concerns have therefore installed automatic dipping units. In most cases these units are directly coupled to the drying or baking ovens and this eliminates unnecessary handling. The time and heat factors are positively controlled, removing the human element which is quite an advantage.

Work is hung or racked on the machine at the loading end and removed dry and finished at the other.

Production

There are some installations in cheap jewelry manufacturing where one girl will take care of a machine by loading and unloading, a production of 24,000 pieces in 8 hours. This was on the application of a transparent gum lacquer over a cold rolled strip steel part which had been brightly tumbled, copper plated, brass flashed and bronze plated. Each part measured about 4 inches long and final finish was a very good gold plate imitation.

Direct Labor Cost

Assume that the operator earned 30c. an hour; average hourly production, 3,000 pieces. The labor cost is 10c. per thousand pieces.

Direct Material Cost

Material cost figures were surprisingly low. They were based on the quantity made divided into the value of lacquer and thinner drawn from stock and put in the machine and they averaged 15c. per thousand pieces. This, therefore, covered the cost of any spilled, lost, evaporated and the amount actually used; beside which the figure was an accumulative average based on 16 previous months. I was told before the machine was used that the material cost would be over 50c. per thousand pieces. Moreover, rejects were reduced from 10% to practically nothing.

Automatic Dipping and Drying Conveyor

This machine is used for lacquering ladies' hand bag

frames and purse frames and has been used daily since 1927. The racking problem has been solved and there are three different removable racks used at this time. The racks are designed to take care of work measuring about 3 inches long up to 10 inches. Racks are placed on flights which are evenly spaced and held to conveyor chains.

It is necessary to produce the frames so that they are entirely coated and without a run, sag, or drip. The finishes are gold, silver, brass, copper, nickel, etc., in highly polished and satin or brushed finishes. The base metal used is mostly brass and cold rolled strip steel.

It is essential that the lacquering be done properly, with correct thickness of coat, hardness and adhesion, due to the hard usage that the article is finally put to.

The dipping unit contains a galvanized iron tank—tin coated inside—and holds about 75 gallons of mixed

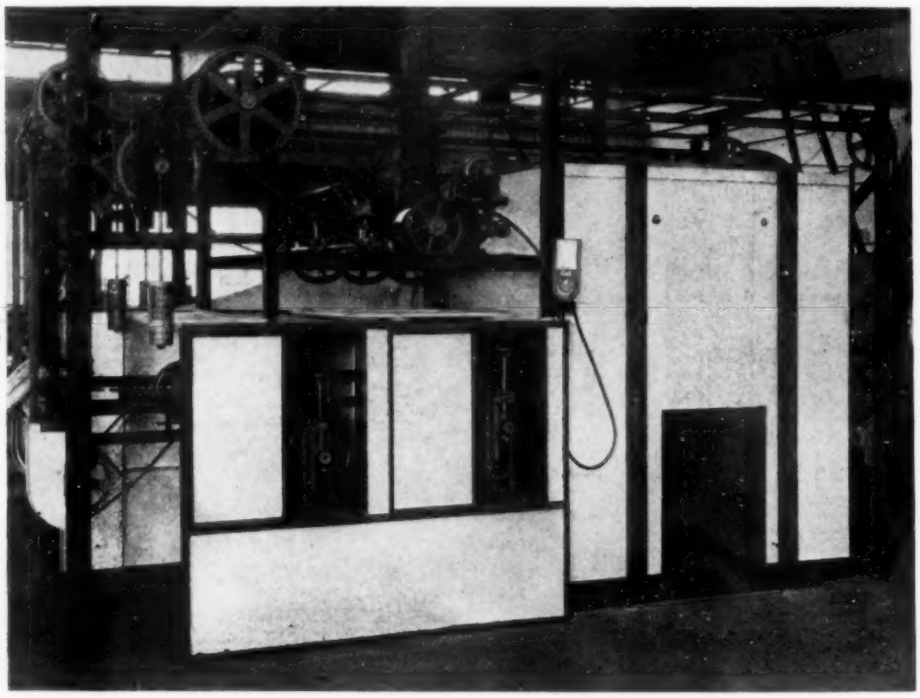


Fig. 1. Side View of Lacquering Machine

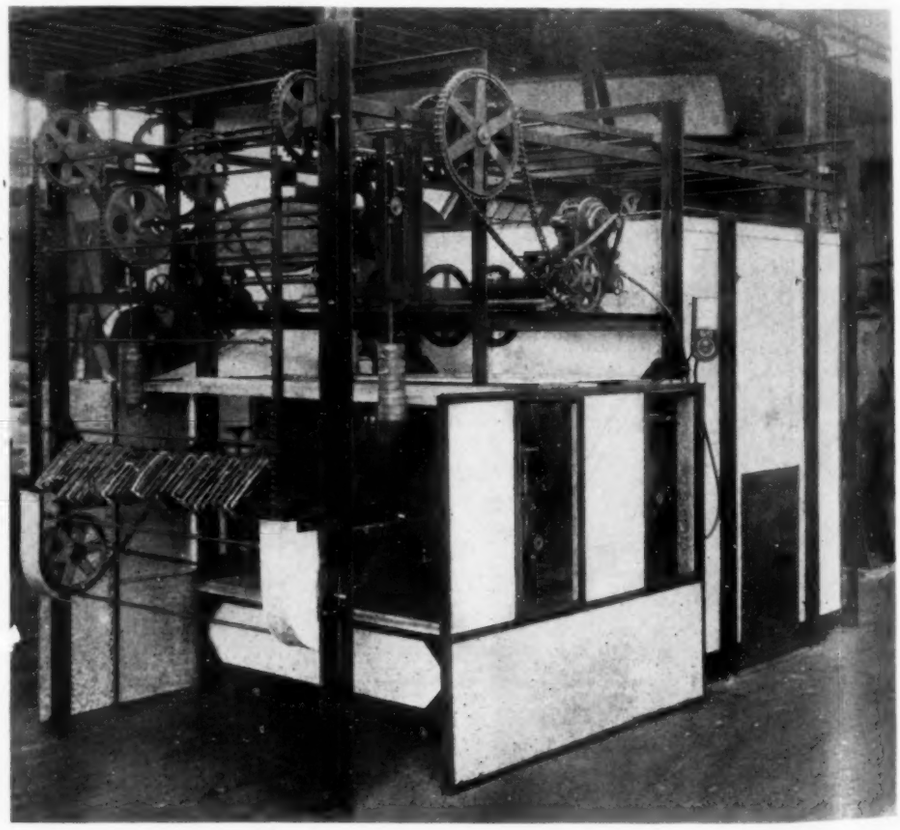


Fig. 2. View of Loading End of Lacquering Machine, with Work Entering

lacquer and thinner. The additions of lacquer and thinner are made daily and in the right proportions.

The drying unit is well insulated, heated with steam and is held at an even heat of 110°-125° F. The heating unit can be electric, steam, or indirect gas.

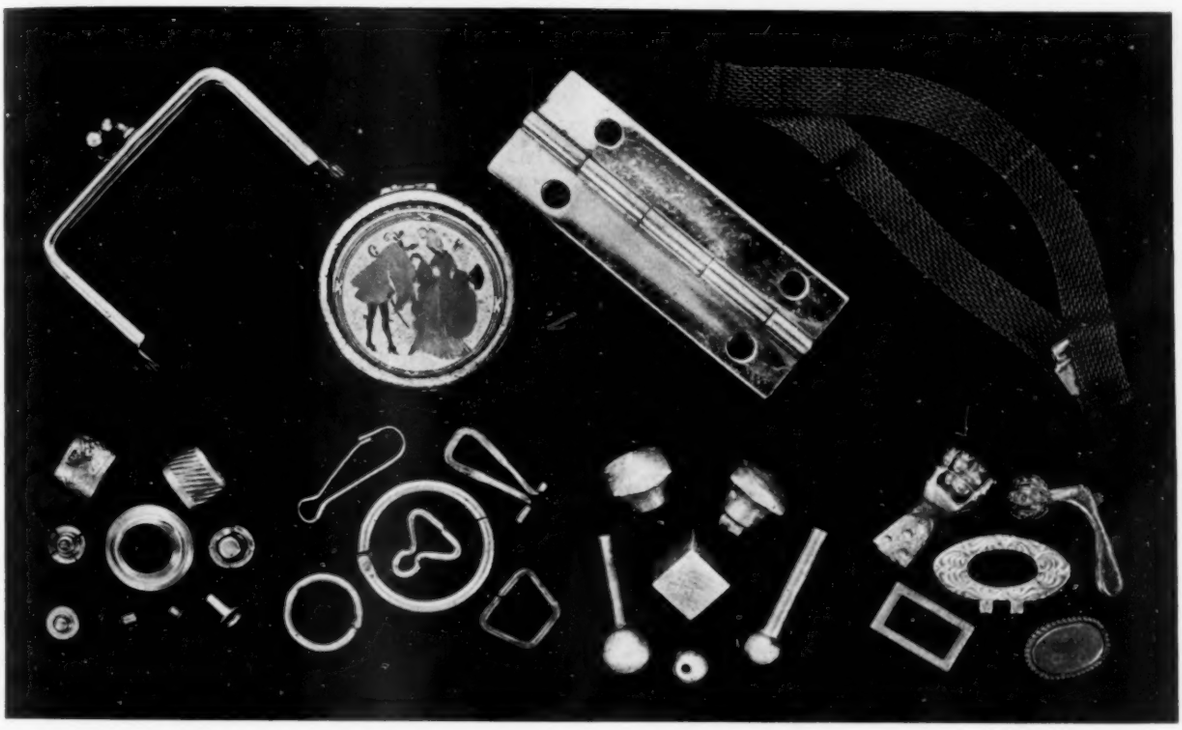
The transmission is equipped with a variable speed control (5 to 1 ratio) whereby the speed of the machine may be readily and without loss of time, changed to the different speeds which are better for different finishes and kinds of work.

The machine can be designed so that it can be used for different colors and variations in the heat requirements.

covering, insurance of the entire surface being covered, work dry when at the end of machine and a much superior finish. The machine method is much lower in both cost of labor and material.

Tumbling Method

Small parts such as wire formed parts, stampings, screw machine products, eyelets, fasteners, etc., generally placed on screens or specially constructed racks, can very nicely be handled in large quantities by the use of a specially constructed tumbling barrel which is inexpensive to make and maintain. The saving in



B C D E

Fig. 3. Top Row—Some of the Articles Now Being Automatically Lacquered. Bottom Row—Parts Which Can Be Tumble Lacquered: B—Parts Made on Eye Machines; C—Parts Made on Wire Forming Machines; D—Parts Made on Automatic Screw Machines; E—Parts Made on Power Presses

The machine pictured above when first in use superseded about 15 spray booths and operators; also 10 drying ovens.

Advantages

The saving in floor space, confusion, quality improvement, handling, etc., was quite a factor, besides the large reduction in both direct labor and material.

The right kind of installation practically does away with management's problem of the application of a protective coating.

Humid days—lacquer blushing (getting white) is forgotten. It is not necessary to buy retarders, etc. Work can be done on hot, humid days. The heat from the drying unit is dissipated over the tank and thereby keeps all moisture out of the mixed lacquer and thinner. To most manufacturers this is quite a problem.

The outstanding features are that the machine eliminates entirely the human element factor by being automatic in its timing, thereby getting a uniform

cost of labor alone will in most cases pay for the unit within a few months.

Equipment for Finishing Generally Obsolete

It is too bad that the finishing operations of our industry have not advanced to more automatic equipment like the previous operations, such as punch press, automatic screw machine, wire forming machine, eyelet equipment, etc. How often we see firms with the most modern equipment for the manufacturing operations, and old obsolete machinery, makeshift affairs, for the finishing. More surprising is this when we know too that the most of the cost to manufacture is in the finishing. Furthermore we know that if the final finish is not right we can expect plenty of sales resistance. True also, is the fact that in most concerns the "bottle neck" of the production is generally in the finishing operations, such as plating, polishing, enameling, lacquering, etc.

Aluminum Bronzes and Their Heat Treatment

The Uses, Foundry Characteristics, Structure, Melting Methods and Heat Treatment of These Interesting Alloys.

By M. G. CORSON

Consulting Metallurgist, New York

TO DERIVE the maximum benefit from the present article the reader must bear in mind a clear picture of the general situation in the field of aluminum bronzes.

All told there are 27 places in the whole world where aluminum bronze is manufactured on anything resembling a production basis. Of these, seven are located in the United States, four in England, four in France, five in Germany, three in Italy, two in Austria and two in Russia. It is a small number compared to that of all copper base alloy foundries and rolling mills.

Uses of Aluminum Bronze

The main reason why these places use aluminum bronze is the fact that its resistance to atmospheric corrosion is very high indeed, and to sea water, quite fair. Further, the absence of hot shortness and of corroding action upon steel make it possible to produce rather intricate articles by the way of permanent mold casting. And last but not least, the price which articles of aluminum bronze command, when made to order, is rather high, if not altogether fancy.

A number of the manufacturers of aluminum bronze limit their efforts to the production of small amounts of rolled shapes and sheets. These do not go beyond eight (mostly seven) per cent aluminum in their compositions. In these cases the best melting facilities available are reserved for brass and other large scale products. Aluminum bronzes are made in the old pit fires and the melters can claim no special skill whatsoever. There is nothing secret or intricate about the processes used. Other aluminum bronze manufacturers specialize in sand castings for closely defined requirements. Their products must possess a strength of about 85,000, a yield point of 30,000 and an elongation of 35%. These features are obtainable with ease in alloys containing about 8.5% aluminum and 3% iron. Ninety-nine per cent of the castings (except in France) are made in green sand molds, not even skin dried, and the metal is prepared in the old pit fires or oil fired tilting furnaces. Neither a superior skill nor a careful control of technique is used, nevertheless rejections are not high.

Practically the same composition is used by the makers of aluminum bronze "die castings" (actually permanent mold castings). This being a comparatively new development (about fifteen years old), the technique is frequently more refined. Electric furnaces are by no means rare and some plants use suction for filling their molds. Others stick, however, to a coke fired furnace built at the outlay of a few dollars, and use their least experienced men to do the melting and casting. Nevertheless the slight effort bears good profit, and as long as no high demands are put in regard to the ultimate strength, hardness and elongation, everything goes smoothly. That high strengths form by no means the first requirement to consider can be seen from the fact that in certain cases a definite maximum strength is specified. "The alloy shall not possess over 75,000 lbs. per sq. in." The reason is that the article will be put to work in a chain where other members are made of porcelain or bakelite and the first condition is that the metal part must go before the porcelain cracks.

If we exclude those foundries which engage in strictly routine work of making rolled shapes, tubes, permanent mold castings, sand cast propellers and forged bars for pickling equipment, we hardly find five or six in the world that truly specialize in aluminum bronze castings and try to make them available for any type of need where the chemical properties of aluminum bronzes may do.

Foundry Characteristics of Aluminum Bronze

In the light of the above said we shall treat our subject so as to give the foundryman some definite information first and clear cut instructions later. The latter must not be followed if they were the Bible itself. They are not intended for the man who must make profit from the first casting produced. Some experimenting will always be needed.

Every kind of binary aluminum bronze containing from one to thirteen per cent aluminum can be used for certain castings, whether in sand or permanent molds and all kinds can be hot forged and hot rolled. Between 7 and 8.5%, hot rolling is somewhat delicate, especially at the very beginning, but it can be done.

Aluminum bronzes can show from 35,000 to 115,000 ultimate strength, 45 to 350 Brinell hardness and from 60 to 3% elongation within the range of useful compositions. The field of their uses must consequently be quite large and diversified.

No aluminum bronze tends to be naturally porous when cast, provided it has been properly made. Nothing is easier than making a good sized cast kettle of aluminum bronze that must withstand a high hydraulic or gaseous pressure. But the shape of that kettle must be rather plain. Corners, bosses and changes in cross-section must be avoided. Intricate castings required to withstand a high pressure can

be made but not in a simple way. Special fixtures will be necessary to provide for the proper filling and feeding of such a mold, and consequently the cost of production will be rather high.

On the other hand, while plain pressure castings can be made easily from a carefully made metal, other castings, like propellers do not require any special technique. The slight refinements in the pouring procedure as compared to castings in other alloys are plain.

One of the bogey men of the would-be aluminum bronze founder is the problem of oxide inclusions and deoxidation. The reader must bear in mind that no such problem really exists. Molten aluminum bronze contains no oxides to speak of and they cause no harm. Harm is due to oxide caused by the tough film that covers the molten metal, protects it from further oxidation and which cannot be removed; also to the film that forms around the stream of the molten metal when it runs from the ladle into the mold. Broken stretches of this film can enter the mold and stop in any convenient nook or corner. Here they will cause porosity. Therefore intricate molds are difficult and require a special technique. To cast a long and heavy pipe of 3,000 lbs. is easier than a valve body of some twenty lbs. weight.

Otherwise oxide inclusions are rare and harmless, except where surface polish is of great importance. And they are too small and thin to dull or break the tools in machining. This trouble, when it happens, is caused by highly carburized inclusions of iron.

While plain binary aluminum bronzes are best for the rolling mill specializing in high ductility stock with 6-7% Al (it has up to 75% elongation in 2" when well annealed), and while they can be used by the foundryman, there is no reason at all to stick to binary mixtures. At the same price, bronzes containing up to five per cent iron will show higher strength and higher elastic limit and their running properties are just as good. Further improvements in strength and hardness for a given aluminum content can be obtained by adding small amounts (up to 2%) of manganese and nickel, especially the latter. But their running characteristics are not so good. They are somewhat sluggish.

To understand what additions can do to aluminum bronzes we must discuss the structure of aluminum bronze and its changes with the temperature.

Structure of Aluminum Bronze

Any plain aluminum bronze with over 9% and up to 16% aluminum crystallizes in large mostly equiaxed grains, rarely less than ⅛" in diameter; sometimes they may be 1". They are called the beta phase. This beta phase is extremely malleable but not ductile, resembling lead in this respect. It can be forged, rolled and pressed, but not drawn or spun.

On cooling, the beta grains start to dissociate. The temperatures at which this process begins depend upon the aluminum content. But they are not precisely known. In round figures the point at which this transformation begins drops from 1000° C for a 9% Al alloy to 570°C for a 12% or roughly, 150 degrees C per each additional per cent Al above 9%. A 10% bronze will start to dissociate at 850° C and 11% at 700°. Above these points they are stable.

Down to 570° C the process consists in the precipitation of grainlets of the alpha phase resembling in their fine structure, copper or standard brass. It is highly ductile and forms the basis of the rolled aluminum bronze products. At first these grainlets are imbedded in a ground mass of beta.

Just above 570° C the first stage of the beta dissociation is complete and the alloy is composed of the maximum amount of the alpha phase possible, while the remaining amount of beta is minimum. If the alloy contains about 11.9% Al and no other alloying elements are present it will still be 100% beta. With less aluminum it will contain more and more alpha. As frozen and cooled in the sand mold the alloy will contain no beta if its aluminum content is lower than 6%. A 10% aluminum alloy will contain at 580° C about 66% of beta and 33% alpha as sand cast.

At 570° C and below, the beta phase is unstable. Its grains transform according to the speed of further cooling either into another phase that looks "acicular" under the microscope, or into a mixture of much finer particles of that same ductile alpha with a new phase, "delta" quite hard and brittle. But so is the "acicular" phase, too.

The fact that both "delta" and the acicular phase are brittle does not by any means make the alloy containing them brittle. (A high speed steel, as annealed, contains some 15% of hard and brittle tungsten carbide, but is not brittle at all). It all depends upon the amount of alpha and the manner in which it is distributed through the grain. If all alpha, no matter how scarce, forms a net-work into which the hard phase is imbedded like islands, the alloy will be hard and strong but still **reasonably ductile.** But once it happens that alpha forms **separate islands** while the brittle phases form the envelopes of the grains or their skeletons, the whole article becomes brittle and most frequently worthless. This is quite likely to happen in a 10% sand cast Al bronze of 33% alpha only. The Greeks used to call it "self annealing." In alloys with 9% Al the amount of alpha never drops below 50% and for this reason they do not "self anneal."

Consequently the efforts of the foundryman must be so directed that either the beta stays intact or the amount and distribution of alpha are such as to insure enough ductility. Cutting down the content of aluminum is one way to obtain ductility as it insures a sufficient amount of alpha. But it does not give us a strength over 85,000 lbs. and the hardness remains low, not over 110 Brinell, (in ternary aluminum-iron bronzes).

Other methods to cope with the brittleness caused by improper distribution of the brittle phases consist in (1) alloying, (2) heat treating.

Of alloying agents, iron, manganese and nickel are the most potent, though the manner in which they influence aluminum bronze is still obscure and most certainly not identical. We shall not go into this discussion. Suffice it to say that even a bronze with 11% aluminum will retain considerable ductility as sand cast, provided it contains 5% iron. Why, even a 13% aluminum meta alloy that contains practically no coherent patches of alpha in the plain binary composition and is therefore utterly brittle, will remain tough enough to form all kinds of tools when containing 5% iron.

Of other elements practically all are harmful, particularly silicon, phosphorus, lead, zinc. It is claimed, however, that about 0.3% tin has a favorable action upon alloys containing below 11% aluminum; at any rate it seems to do no harm.

The use of iron permits us to go quite high in aluminum and obtain high hardnesses without any heat

treatment. With 13.5% aluminum a hardness of 330 Brinell is obtained automatically. With 11% it stops at about 200 Brinell but can be raised by heat treatment to about 300 Brinell.

Ultimate strength, however, does not follow suit. A carefully prepared alloy with 11% Al and 4% Fe will possess 100,000 lbs., p.s.i. strength, but this will decrease with higher contents of Al. To combine a higher hardness with a strength of over 100,000 an elastic limit of 70,000 lbs. p.s.i. and to retain an elongation of 5-10% at least, a combination of the best melting practice with an appropriate heat treatment must be used.

Proper Melting

It is possible to make an acceptable, simple-shaped casting under nearly any foundry conditions available. One may use all sorts of copper scrap, any kind of furnace and fuel and any sort of melter who is willing to stand the heat and dirt for a few dollars a day. But it is impossible to make high grade castings under such conditions except by coincidence. For guaranteed aluminum bronze products commanding about 45 cents per lb. even in depression times a far better practice must be adhered to, namely:

(1) Use a large size furnace (tilting) by preference. Gas is the better fuel. But the burner shall not be constructed with the maximum fuel economy in mind. The flame must rise almost vertically without any spiraling, or gases will penetrate into the crucible and dissolve in the metal.

(2) One may use a coke fired furnace. It is quite a good tool in the proper hands. But care must be taken that the crucible does not sit a mile or so down in the pit. This is neither needed nor convenient. The crucible's top must not be more than one foot below the cover of the pit; and use a coke that carries little sulfur if any.

(3) If the crucible can hold 600 lbs. of bronze do not try to use every cubic inch of it. Do not melt over 450 lbs. per charge.

(4) Scrap copper contains gas. Aluminum will not remove it. Gas is much worse than oxides; it accounts for 50% of the possible porosity and discolored fractures. The other 50% are due to shrinkage not sufficiently provided for. Use "oxygen free" copper by preference, or if you cannot get it, use good cathode copper from a refinery treating high purity anodes. Where impure anodes are treated, current conditions are such as to cause the cathode to include a considerable amount of hydrogen.

(5) Use no charcoal to prevent oxidation. In a fight for oxygen, liquid copper may beat charcoal and aluminum will certainly do it. Even should your copper become oxidized in melting to the extent of containing about 0.1% oxygen it will take only about .1% aluminum to remove it.

(6) Put the copper into the crucible packing it closely, but do not let any of it stick out. Then close the crucible with a heavy refractory cover overlapping its edges. Make a few tests to find out how rapidly your furnace works and make it a practice to melt by **the clock** without removing the cover needlessly. To prevent furnace gases from getting into the crucible is impossible but one can make sure that the gases will not needlessly lick the metal in a continuous stream.

(7) When all copper is molten the time comes to introduce the iron. This can be made in two ways:

(a) Get a supply of Armco iron sheets about 1/64" thick, cut it up into strips about 6" long and 2" wide and have them copper plated. This will save the trouble of looking up some scrap iron and cleaning each piece individually.

Put the whole amount needed of such strips into the molten copper and push them down with the iron stirring bar. Cover up the crucible and run the furnace full blast for ten minutes. The larger part of the iron will be dissolved by that time.

Now stop the furnace, remove the cover from the crucible and quickly add all the aluminum. The temperature will jump some 150 degrees centigrade and it will help to dissolve all the iron.

Stir the metal for a minute with a bar, flattened and turned at the lower end. It will show you whether all iron is dissolved.

(b) But the above is not the best way to introduce iron. The molten metal will be exposed to the action of gases for some twenty minutes at least. It will not be ruined, but its quality will be lowered.

It is better to order from some foundry, properly equipped, a supply of a master alloy containing 60% aluminum and 40% iron and made in a basic crucible (otherwise there will be some silicon and graphite in the alloy). This master alloy will dissolve in copper almost instantaneously and after the proper amount of additional aluminum is put in, the metal is ready for pouring. In this case hardly more than 6 minutes will pass between the moment that all the copper is molten and when the metal is ready for pouring so the metal will contain the minimum amount of gas.

(8) The temperature of pouring is not of great consequence. If the metal is not gassed it might go up even to 1300° C without affecting at all the quality of the castings. But be it even only 1150° C, or so, the peculiarly low heat conductivity between the surface film and any contact substance will maintain the metal fluid enough to fill out any non-too-intricate mold. This feature belongs to aluminum bronzes in common with any copper base alloy containing over 1% aluminum.

(9) Most of all, do not try to economize on the wages of the melter. It may be all right to have one man tend ten furnaces in making red brass where the profit margin is low. In the case of aluminum bronze one man, and a very intelligent man, must be attached to every single furnace. If he helps to turn out 1,000 lbs. of quality castings per day, (and this can be easily done with a tilting furnace of 600 lbs. theoretical capacity), his wages of $6.00 per day will be well earned. A metal selling at 40-45 cents per lb. will easily warrant .6 cents labor cost per lb. for good melting.

(10) In pouring aluminum bronze the main refinement consists in providing a small basin on the top of the cope, a horizontal channel for the flow of the metal from it over quite a distance (to let the broken up film of oxide float out) and a well inclined runner connecting to the base of the mold. Aluminum bronze must flow—not drop into the mold.

(11) Castings not intended for internal pressure can be made well enough in green sand. For internal pressure castings dry sand molds are more desirable. For valve bodies and the like chills must be used liberally along corners and fillets. It is not worth while to take orders for a small number of such castings. To make them properly, specialized fixtures are needed so as to exclude all dirt, pour the metal from the bottom of the ladle into the bottom of the mold and to provide risers that **will stay** quite liquid until the whole casting is solidified.

Characteristics

Using the procedure here described high quality castings may be had in all compositions possible. We shall mention, however, three specific alloys that may be taken up as standards by the foundry.

(1) 9% Al, 3.5% Fe, with or without 1% Mn and 1% Ni; the last to be used when the metal does not have to run most freely.

Characteristics: 25,000 lbs. elastic limit; 35,000 yield point; 85,000 ultimate strength; 30% elongation in 2", and 110 Brinell.

(2) 10.3—10.5% Al, 4.5% Fe, 0.3% Sn, with or without Mn and Ni.

This alloy may be counted upon to show: 40,000 lbs. elastic; 55,000 lbs. yield point and 95,000 ultimate strength, with 15% elongation and 140 Brinell.

(3) 11% Al, 5.0% Fe, 1% Mn, 1% Ni.

Its characteristics as sand cast will be: 45,000 psi elastic limit; 70,000 yield point; 100,000 tensile; 6% elongation and 200 Brinell.

Chill casting will increase ultimate strengths of these alloys by 10, 7 and 5 thousand lbs. and forging by 15, 12 and 10 thousand lbs. respectively.

Heat Treatment

All three compositions can be made considerably stronger, more elastic and very much harder by giving them a proper heat-treatment. The difficulty is that at least two furnaces of proper size and design must be available and closely controllable. For the first of the heat treatment stages a gas furnace with automatic control is quite sufficient. For the next stages only electric furnaces will give reliable conditions. Very few foundries are so equipped and at least the second stage is frequently done in a careless manner "hoping for the best," because no attached test bars are demanded.

The first stage consists in homogenizing the articles, i.e. bringing them into a nearly pure beta state so that the next stages may be better controlled as to the amount and distribution of the alpha phase. But it is not desirable to heat up to the point where all alpha originally existing disappears. It is better to let some (about 10%) remain. This checks the growth of the beta grain and provides starting nuclei for the building up of the alpha phase during the second treatment.

The proper temperatures for this heat treatment are:

For the 9% alloy, 875 C; 10.3%—800 C; 11%—725 C.

The homogenization proceeds rapidly when the proper temperature is reached. But the time factor depends upon the size of the piece and its shape. In the average two hours will quite suffice. Then the articles are quenched in water.

This will bring them into the state of maximum hardness, exactly as is the case with carbon steel. The ranges of hardnesses so obtained are: 200, 250 and 320 Brinell. But the elongations will be low: 15, 5 and nearly 0%, in spite of the presence of iron.

The next stage consists in reheating to a point where the structure will change to a controlled arrangement of alpha and beta. It is desirable to do it at a temperature where, given proper time, not less than 25 and not over 50% alpha shall be present in the shape of a nearly continuous network, especially at the grain boundaries. The specific temperatures will be approximately: 720°, 650° and 580° C. As to the duration of the heating; four hours will be enough for the first alloy, eight hours for the second and overnight (16 hours) for the third. This heat treatment should again end in quenching, or air cooling but not furnace cooling. The time factor can be and is shortened only too frequently. In certain cases the quenched castings are merely returned to the very same furnace when its temperature drops to 600 C and allowed to cool there. It is not the best method to use.

After this second treatment the hardness drops, but elongation and strength increase. One will obtain:

95,000 psi strength with 20% elongation and 170 Brinell.

105,000 psi strength with 15% elongation and 220 Brinell.

110,000 psi strength with 8% elongation and 260 Brinell.

Next, the articles can be given another hardening treatment for a short time at 400 C. This will leave the strength unaffected and the elongation cut to about 12, 8 and 3%. Hardness will go up by some 30-50 units.

Soldering Key Heads

Q.—We are soldering gold ornaments on blank keys in place of their regular heads. In so doing we lose the temper of the blanks which in the case of hard turning locks tend to twist out of shape.

Is there any way of preventing this loss of temper? If such is impossible, can you tell us if there are any blanks on the market of a different alloy so as to withstand the possible loss of temper, and who is the agent?

A.—The simplest method of producing a strong joint between the ornamental heads of the keys would be to use a low temperature solder. Deepen the socket or slot in the head and cut it with a close fit on the key. This method would make a much stronger connection than your present method with the hard solder, and at the same time it would not anneal the steel.

If the steel is too weak for the service, use stainless steel for the key. This is the strongest kind of metal and at the same time it will always stay bright. A low melting solder would not reduce the hardness or the strength of this metal. By selecting the proper composition of solder, this would flow into the close fitting joint and make a very strong connection. Also, the joint with very little clearance would greatly reduce the amount of the solder to be used.

— W. B. Francis.

American Society for Testing Materials Meeting

Symposium on Radiography; Spectrographic and Chemical Analysis; New Standards for Non-Ferrous Metals.

ONE of the major features of the Thirty-ninth American Society for Testing Materials Annual Meeting, held at Chalfonte-Haddon Hall, Atlantic City, June 29-July 3, inclusive, was an address on the "Relationship of A.S.T.M. to Modern Developments in Chemical Engineering" by **Dr. H. C. Parmelee,** editor, Engineering and Mining Journal. This address was given in the opening session on Tuesday morning, June 30, at which time the President, H. S. Vassar, gave the President's Annual Address.

At the nineteen session of the meeting, were given some 120 technical papers and reports. Of the 70 papers, twelve comprised the extensive Symposium on Radiography and X-ray Diffraction Methods to which four sessions were devoted on Tuesday and Wednesday. This symposium covered the application of these methods to metallics and non-metallics.

Other groups of papers pertained to Spectrographic Analysis, Non-Ferrous Metals, Paint, etc.

Since 1936 is a year of publication of the triennially issued Book of A.S.T.M. Standards, many of the Society committees had extensive reports giving their recommendations on many specifications to be adopted as standard and included in the volume. A large number of new proposed specifications were approved at the meeting for publication covering many materials for which standardized requirements have not previously been issued. About 50 reports were presented in abstract by the various officers.

H. C. Mann, Senior Materials Engineer, Ordnance Department, U. S. Government, Watertown Arsenal, was chosen as the winner of the **Charles B. Dudley Medal** for 1936. This medal, which commemorates the name of the first A.S.T.M. President (1902-1909), is awarded to the author of the paper presented at the preceding annual meeting which is of outstanding merit and constitutes an original contribution on research in engineering materials. The medal was awarded Mr. Mann on July 1 during the 1936 A.S.T.M. annual meeting in Atlantic City.

The winning paper entitled "The Relation Between the Tension Static and Dynamic Tests" presented data and conclusions from an investigation which led to the discovery of a correlation between static and dynamic tests. This correlation involves consideration of the fact that a material in its initial state possesses a certain amount of inherent internal potenial energy which, during the process of deformation, is apparently converted to kinetic energy and manifested as increased elastic strength.

New Officers

Official notice of election for officers of the American Society for Testing Materials was given at the first session of the A.S.T.M. annual meeting, June 30, in Atlantic City.

President: (Term—one year):

A. C. Fieldner, Chief Engineer, Experiment Stations Division, U. S. Bureau of Mines, Washington, D. C.

Vice-President: (Term—two years):

T. G. Delbridge, Manager, Research and Development Department, The Atlantic Refining Company, Philadelphia, Pa.

Members of Executive Committee: (Term—two years):

O. U. Cook, Assistant Manager, Department of Metallurgy, Inspection and Research, Tennessee Coal, Iron and Railroad Company, Birmingham, Ala.

H. F. Gonnerman, Manager, Research Laboratory, Portland Cement Association, Chicago, Ill.

C. S. Reeve, Manager, Research Development, The Barrett Company, Leonia, N. J.

F. E. Richart, Research Professor of Engineering Materials, University of Illinois, Urbana, Ill.

F. M. Waring, Engineer of Tests, The Pennsylvania Railroad Company, Altoona, Pa.

Papers and Reports on Non-Ferrous Metals and Metal Coating

Symposium on Radiography and X-ray Diffraction Methods

The symposium on Radiography and X-ray diffraction was developed by Subcommittee VI on X-ray Methods of A.S.T.M. Committee E-4 on Metallography. Preliminary sessions were held at the June, 1935, meeting in Detroit, at which many technologists in this field presented discussion and material which it is planned will be the basis of the formal symposium. The object of the symposium was to present summary accounts of the present status of X-ray methods in the testing of materials so that the practical usefulness of such methods may be evaluated. The following items elaborate this general statement:

(a) To describe methods and equipment in an elementary way in order to assist industries in the application of X-rays to their work.

(b) To present as many case histories of successful applications as possible.

(c) To compare the usefulness of X-ray methods with the usefulness of other methods which may be used alternately.

(d) To include the application of radiographic and diffraction methods to both metallics and non-metallics.

In all, there were twelve papers—six covering radiography and six diffraction. Four Sessions of the meeting were devoted to these papers.

Principles of the Radiographic Problem. J. T. Norton, Massachusetts Institute of Technology.

Foundry Applications of Radiography. Earnshaw Cook, The American Brake Shoe and Foundry Company.

Application of Radiography to the Welding Art. J. C. Hodge, The Babcock & Wilcox Company.

Miscellaneous Applications of Radiography and Fluoroscopy. H. E. Seeman, Eastman Kodak Company.

Gamma-Ray Radiography and Its Relation to X-ray Radiography. N. L. Mochel, Westinghouse Electric and Manufacturing Company.

The Problems of Radiographic Specifications. H. H. Lester, Watertown Arsenal.

Report of Committee A-5 on Corrosion of Iron and Steel. F. F. Farnsworth, Chairman.

New tentative method for the uniformity of coating by Preece test (copper sulfate dip) on zinc-coated (galvanized) iron or steel wire. Interesting summary of activities of subcommittees including latest results of inspections of the atmospheric tests at Annapolis and the total immersion tests. Data on inspections of galvanized sheets after 9 years' exposure. Progress of tests on metallic-coated hardware, structural shapes and tubular goods. Extensive research program on the outdoor corrosion of wire and wire products.

Report of Committee B-3 on Corrosion of Non-Ferrous Metals and Alloys. T. S. Fuller, Chairman.

Brief progress report on activities of subcommittees on the salt spray test, atmospheric corrosion, corrosion in liquids, and on galvanic and electrolytic corrosion.

Report of Joint Committee on Exposure Tests of Plating on the Non-Ferrous Metals. William Blum, Chairman.

General plan of exposure tests now under way at six test locations representing different types of atmospheric conditions. Detailed information on compositions of the base metals, which include steel, gray iron, malleable iron, copper, brass, nickel-brass, rolled zinc and zinc die castings. Detailed tabulation of schedule of the deposited coatings which comprise nickel, copper and chromium.

Report of Joint Research Committee of A.S.M.E. and A.S.T.M. on Effect of Temperature on the Properties of Metals. H. J. French, Chairman.

Reviewed the work of the committee during the past year. Appendices giving details of the progress made in various researches.

Slow-Bend and Impact Tests of Notched Bars at Low Temperatures. H. F. Moore, H. B. Wishart and **S. W. Lyon,** University of Illinois.

Results were given of a series of slow-bend and impact tests of various metals at both room temperatures down to —40 F. The object of the study was to see whether the same degree of correlation between slow-bend tests and impact tests of notched bars holds for low temperatures as has been shown to be the case by Petrenko for room temperatures. A special automatic-autographic slow-bend testing machine has been constructed for the tests, and the impact tests are made with an Izod impact testing machine.

Creep Test Machine. F. H. Morehead and J. J. Curran, Walworth Co.

Some Creep Tests on Lead and Lead Alloys. A. J. Phillips, American Smelting and Refining Co.

Presented in graphical form data obtained from long-time creep tests (up to 4 yr.) on certain pure leads and lead alloys. Demonstrated that creep strength on lead alloys cannot be connected in any way with the tensile strength, since most hard alloys of lead have lower creep strength than soft lead. The heat treatment of certain alloys has tremendous influence upon the creep, particularly under high loads.

Equipment and Methods. C. S. Barrett, Carnegie Institute of Technology.

Constitution of Alloys. K. R. Van Horn, Aluminum Company of America.

Chemical Analysis. W. P. Davey, Pennsylvania State College.

Cold Work, Recrystallization, and Preferred Orientations. J. T. Norton, Massachusetts Institute of Technology.

Particle Size Determinations. G. H. Cameron, Hamilton College and **A. L. Patterson,** Massachusetts Institute of Technology.

Report of Committee E-3 on Chemical Analysis of Metals. G. E. F. Lundell, Chairman.

Reported completion of analytical methods for the determination of carbon, manganese, phosphorus, sulfur, silicon, copper, nickel, chromium, vanadium, molybdenum, titanium and tungsten in steel and iron to replace the present standard methods of chemical analysis of plain carbon steel, alloy steels, pig and cast iron, and methods of sampling rolled and forged steel products for check analysis. Reported preparation of draft of analytical methods for the determination of nickel and silicon in brass ingots and sand castings and that consideration is being given to procedures for the determination of lead, tin, and iron in these alloys. A method for determination of aluminum in iron-chromium-aluminum alloy is being developed.

Report of Committee E-2 on Spectrographic Analysis. H. V. Churchill, Chairman.

The Spectrographic Determination of Small Quantities of Arsenic in Lead, Copper and Their Alloys. Frances W. Lamb, Bohn Aluminum and Brass Corp.

The need for a method which permits a comparatively rapid and reliable determination of small quantities of arsenic in metals having small percentages of arsenic present as an impurity, and as a control method for alloys to which small amounts of arsenic are added. Problems met on developing a satisfactory spectrographic method. Procedure and apparatus including the use of special ultra violet sensitive plates in order to increase the sensitivity of the arsenic line at wave length 2349.84 I.A., and results illustrated by 2 or 3 spectrograms and a working curve. The advantages of this method in comparison with present chemical procedures.

Spectrochemical Analysis of Nickel Alloys for Various Additions or Impurities. C. J. Neuhaus, The International Nickel Co., Inc.

Present equipment, its limitations and how these were, at least partly, overcome by developing special methods for various elements. Methods for the elements lithium, boron, magnesium, aluminum, calcium, titanium zirconium and lead, special considera-

tion being given to the selection of spectrum lines, mode of excitation and electrode types.

The Spectrographic Determination of Magnesium in Aluminum Alloys. W. R. Koch, U. S. Army Air Corps, Wright Field.

Compared photometrically the spectra of a series of aluminum-magnesium alloys with those of similar alloys containing appreciable amounts of either copper, iron, manganese or silicon. Results obtained from arc and spark spectra. Aluminum alloys containing magnesium in concentrations from 0.01 to 5.0 per cent.

Developments in the Quantitative Analysis of Solutions by Spectrographic Means. O. S. Duffendack and **K. B. Thomson,** University of Michigan.

Report of Committee E-1 on Methods of Testing. W. H. Fulweiler, Chairman.

Report of Sectional Committee on Specifications for Sieves for Testing Purposes. L. T. Work, Chairman.

Applications of the Wedge Extensometer. W. M. Wilson, University of Illinois.

High Velocity Tension Impact Tests. H. C. Mann, Watertown Arsenal.

Report of Research Committee on Fatigue of Metals. H. F. Moore, Chairman.

Report of Committee B-I on Copper and Copper Alloy Wires for Electrical Conductors. J. A. Capp, Chairman.

New Tentative specifications for hard drawn copper alloy wires. Recommended adoption as standard of tentative specifications for bronze trolley wire to replace the existing standard and adoption of tentative revision in standard specifications for copper trolley wire.

Torsion and Flexure Testing of Copper Wire. S. E. Borgeson, General Research Laboratories, General Cable Corp.

Various types of bend tests for copper magnet wire and shows that the mechanical properties they measure in terms of arbitrary scale units may be measured in conventional units by the use of torsion tests. The relation between the mechanical properties of wire as measured in flexure and in torsion and presents results of tests using both methods. A simple type of direct-reading torsion tester.

Effect of Time on Tensile Properties of Hard-Drawn Copper Wire. A. J. Phillips and **A. A. Smith, Jr.,** American Smelting and Refining Co.

Data showing that the determination of tensile properties of hard-drawn copper wire depends to a considerable extent upon the time factor. This phenomenon has tremendous significance in determination of elastic limit. Wire that has been preloaded for several days possesses much better elastic properties than the original hard-drawn copper wire. In fact, pre-loaded wire, with rapid testing, has almost perfect elasticity with an extremely small hysteresis loop.

Report of Committee B-5 on Copper and Copper Alloys, Cast and Wrought. C. H. Mathewson, Chairman.

New tentative specifications for seamless copper-nickel alloy condenser tubes and ferrule stock, for sheet and strip phosphor bronze, for bronze castings in the rough for wearing parts, and for car and tender lined journal bearings. New tentative specifications for bronze castings for turntables and movable bridges as a revision of the existing standard specifications. Revisions of specifications for manganese-bronze ingots for sand castings; for manganese-bronze sand castings. Recommended adoption of revisions of specifications for aluminum-bronze castings; for sand castings of the alloy; copper 88 per cent, tin 8 per cent, zinc 4 per cent; for steam or valve bronze sand castings, and for composition brass or ounce metal sand castings. Revisions of tentative specifications for copper-silicon alloy plates and sheets, for sheet copper-silicon alloy and for copper silicon alloy wire for general purposes. Recommended adoption as standard of the tentative specifications for copper-base alloys in ingot form for sand castings.

Report of Committee B-4 on Electrical-Heating, Electrical Resistance and Electric-Furnace Alloys. Dean Harvey, Chairman.

New tentative method of test for the flexure-temperature characteristics of thermoflex (thermostatic metals) in the form of flat strips. Recommended for adoption revisions in the standard method of test for resistivity of metallic materials, accelerated life test for metallic materials for electrical heating, and test for the temperature-resistance constants of resistance alloy wires; and editorial changes in the standard method of test for thermoelectric power of electrical-resistance alloys. Proposed methods of bend test for wire comprising three types of apparatus and procedures. Brief statements of activities of subcommittees on life tests, electrical tests, mechanical tests, wrought and cast alloys for high-temperature use, and on thermostatic metals.

Bend Testing of Wire for Vacuum Tubes. D. A. S. Hale and **W. J. Farmer,** Bell Telephone Laboratories, Inc.

A test for determining the ability of a wire to resist deformation by impact bending and the development of a pendulum-type machine of sufficient sensitivity to detect small differences in bending resistance. A resume of a number of different methods of measuring stiffness together with comments on the suitability for giving the type of information needed in design problems.

Report of Committee E-4 on Metallography. C. H. Davis, Chairman.

Revisions of the standard rules governing the preparation of micrographs of metals and alloys, and of the standard grain size chart for classification of steels. Recommended the adoption as standard of the tentative recommended practice for metallographic testing of ferrous and non-ferrous metals to replace the present standard methods.

Report of Committee B-7 on Light Metals and Alloys, Cast and Wrought. Sam Tour, Chairman.

New tentative specifications for magnesium-base alloy bars, rods and shapes. A thorough study and review of all the tentative specifications under its jurisdiction, including recommended changes in specifications covering aluminum-base sand casting alloys in ingot form and sand castings; aluminum sheet and plate; duralumin sheet and plate, bars, rods and shapes; aluminum-manganese alloy sheet and plate; magnesium-base alloy sand castings, sheet, forgings, alloy ingot and stick for remelting.

Report of Committee B-6 on Die-Cast Metals and Alloys. J. R. Townsend, Chairman.

Revision of the tentative specifications for aluminum-base alloy die castings, involving the dropping

of alloy No. VI, modification of the composition of alloy No. XII and changes in the tables of properties. Completion of accelerated corrosion studies after one-year exposure to the salt spray test of aluminum alloys Nos. IV, V and Va, and also physical test results. Considerations being given to conduct of tests to determine strength, hardness and aging properties of the lead and tin-base die castings.

Paper appended:

"Finishing Properties of Die Castings" by **J. C. Fox,** Doehler Die Casting Co.

Report of **Committee B-2 on Non-Ferrous Metals and Alloys. R. F. Mehl,** Chairman.

The Effect of the Addition of Lead on the Endurance Limit of a Certain Tin-Base Bearing Alloy. J. N. Kenyon, Columbia University.

The effect of the addition of lead on certain tin-base bearing alloys and presents results of endurance tests on a Babbitt metal (80 per cent tin, 15 per cent antimony, 5 per cent copper) prepared from commercially pure materials, and a second alloy with these elements plus 4 per cent of lead. The two alloys were chill cast into ½ by 5-in. rods, annealed for 12 hr. at 100 C. and turned up into standard R. R. Moore fatigue coupons.

Ductility Testing of Aluminum and Aluminum Alloy Sheet. R. L. Templin, Aluminum Company of America.

Because of the great diversion of opinions as to what constitutes ductility of a metal and as to just what measures this same quantity, it seemed advisable to review a number of existing tests purported to give a measure of this property. Brief reference to the known effects of the size and shape of test specimen and gage length on the ductility measurements obtained from the tension tests. Results of bending tests, Erichsen tests, and tension tests. There is no reliable correlation between them. Results of the Sach's ductility tests with a view to pointing out the difficulties involved in arriving at indices of ductility from this method.

Effect of Iron Impurities on the Annealing of High Brass. W. A. Gibson and **J. H. Doss,** Revere Copper and Brass, Inc.

The effect of iron impurities in the annealing of high brass for temperatures from 600 to 1,200 F. and for iron impurities from 0.008 to 0.287 per cent. The effect of annealing at temperatures from 800 to 900 F. and for iron impurities below 0.10 per cent. The effect of time on the annealing of brass.

Forming Properties of Some Non-Ferrous Sheet Metals. G. R. Gohn, Bell Telephone Laboratories, Inc.

The forming properties of non-ferrous sheet metals. A method of test whereby strips of metal ¾ by 3 in. are bent to determine the minimum safe radius for forming a 90-deg. bend. The test consists of forming a series of such specimens with forming tools having various radii from sharp to 1 in. inclusive. The sheet metal specimens are formed with these tools in a punch press operating at the service rate of 120 r.p.m. Three grain directions were studied with respect to the long dimension of the specimen, namely, parallel, transverse and 45 deg. Standard tempers and gages were tested. Data for a large number of non-ferrous metals—brasses, bronzes, aluminum alloys, etc.

Stress-Relief Annealing High-Strength Monel Metal Plate. P. R. Kosting, Watertown Arsenal.

Results of tests made to determine the effect of temperature of annealing and time at temperature upon the physical properties of high-strength monel metal, ½ in. thick. Plates from four heats were studied. All plates were hot-rolled but finished at low temperature, except some of the plates from one heat, which were cold-rolled 10 per cent. Extensometers of 0.0002 and 0.00002-in. sensitivity were used for determining "yield strength, 0.00 per cent set" (proportional limit).

Casting Pure Nickel

In casting pure nickel a number of precautions must be taken. It can be melted in either an electric or oil-fired crucible furnace, provided a slag is used (preferably glass). The most efficient deoxidizers are silicon and magnesium. For every 100 lbs. of alloy, silicon to the extent of 1.5% should be added to the bath about 5 minutes before pouring time and stirred in quite vigorously. Also, just before pouring, it is desirable to add 1 oz. metallic magnesium for every 100 lbs. of alloy.

High nickel alloys are susceptible to the absorption of furnace gas, and the metal must be protected at all times. The pouring temperatures are well up into the steel range (2800° F.). When casting pure nickel it is desirable to forget practice relating to bronzes and go into the steel operations, as gates and risers are similar to those used in steel practice.

For small work, green sand can be used for the molds but for larger pieces it is desirable to bake the molds thoroughly. If a smooth finish is desired on castings, a little graphite can be slicked on with the fingers.

The characteristics of green molding sand should be as follows:

Permeability, 80-100
Clay cement, 15-23%
Moisture, low as possible (preferably 3%)

There are a number of natural molding sands on the market suitable for the casting of pure nickel, but when in doubt, synthetic sand can be made up from silica grits of No. 85 grain size with the proper amount of clay and water. It is necessary that synthetic sand be well mulled; it cannot be readily mixed by hand, and those foundries having mullers will appreciate this.

Foundries casting Monel metal and pure nickel will progress much further if they keep in mind two things; as the nickel content increases in any composition just so much more supervision is necessary to insure quality castings; also as pouring temperatures increase more steam and gases are generated in the mold. Therefore, it is desirable that the molds be well vented.—**D. M. Curry.**

A New Method of Measuring Electroplates

By DR. W. BLUM and A. BRENNER
Chemist and Junior Chemist, Respectively, National Bureau of Standards, Washington, D. C.

The Application of Mesle's Chord Method in the Measurement of the Thickness of Electro-Deposits.*,†

I. Introduction

IN RECENT years, the tendency has been to specify the **minimum** rather than the average thickness of electroplated coatings. The average thickness has generally been computed from the weight of metal deposited on or stripped from a piece of known area. Metallographic examination has been most commonly employed for determining the thickness at one or more points on the surface. This usually involves plating another metal, such as copper, on the surface to be tested, or else clamping a metal strip against it. The article is then cut through at the desired point, the section is polished, and the thickness is measured under a microscope. This procedure requires considerable time of skilled operators, and the tested specimen is usually destroyed in the process.

The dropping method that was described by **Clark,** and by **Hull and Strausser,** is useful for testing the local thickness of zinc and cadmium coatings. In the **Metal Industry** for August, 1935, **F. C. Mesle** described an ingenious procedure to which the name "chord method" has been given. As he applied it only to silver-plated teaspoons, it appeared desirable to determine its accuracy with various metal deposits on flat and curved surfaces. The results are summarized in this paper.

II. Principles Involved

Two useful ways of applying this method are illustrated in Figures 1 and 2. The former shows a coating on a flat surface that has been just cut through with a grinding wheel of known radius; and the latter shows a coating on a spherical surface that has been just cut through with a flat file. In either case it is necessary to know only R, the radius of the wheel or of the curved surface, and C, the width of the cut (which is the "chord" of the arc covered by the cut), in order to calculate T, the thickness of the coating, according to the equation

$$T = \frac{C^2}{8R}$$

This calculation may be illustrated by typical examples.

(a) On a plane surface—Suppose that when the coating on a flat surface is just cut through with a grinding wheel having a radius of 4 inches (that is, an 8-inch wheel), the width of the cut is 0.2 inch. Then

$$T \text{ (thickness)} = \frac{C^2}{8R} = \frac{(0.2)^2}{8 \times 4} = \frac{0.04}{32} = 0.00125 \text{ inch}$$

(or, for practical purposes, 0.0013 inch).

(b) On a curved surface—Suppose that on a cylindrical tube with a radius of 2 inches, when the coating is just cut through with a file, the width of cut is 0.1 inch. Then

$$T \text{ (thickness)} = \frac{C^2}{8R} = \frac{(0.1)^2}{8 \times 2} = \frac{0.01}{16} = 0.000625 \text{ inch}$$

(or, for practical purposes, 0.0006 inch).

The principal precaution in making such calculations is to check the number of decimal places in the square of the decimal fraction and in the final result. If the approximate magnitude of the thickness is known in a specific case to be, for example, either thousandths or ten-thousandths of an inch, this will serve to check the calculations. In routine testing of similar articles, no difficulty will usually be experienced in making the calculations.

*From The Monthly Review of the American Electro-Platers' Society, April, 1936.

† Publication approved by the Director of the National Bureau of Standards of the U. S. Department of Commerce.

[2] A more detailed report of this investigation including the interpretation of several mathematical formulas, was published in the Journal of Research of the National Bureau of Standards, as Research Paper 866, (February, 1936). Copies of this paper can be obtained from the Superintendent of Documents, Washington, D. C., at 5 cents each. (Stamps not accepted.)

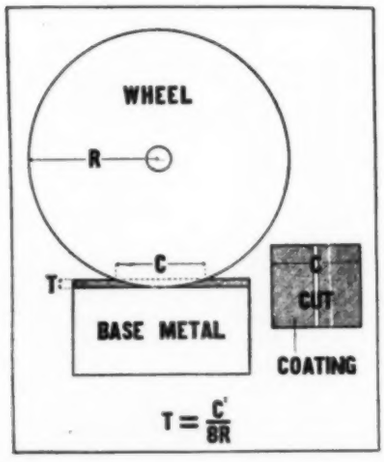


Fig. 1. Testing a Coating on a Plane Surface with a Grinding Wheel

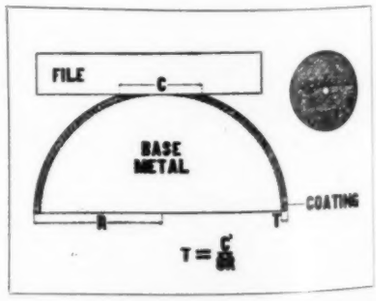


Fig. 2. Testing a Coating on a Spherical Surface with a File

In general, an accuracy of about 10 per cent of the thickness is desirable, and is feasible for coatings at least 0.0002 inch thick. To obtain this accuracy, it is necessary to measure the width of cut with a precision of about 5 per cent. The radius of the wheel or object should be measured with a precision of about 2 per cent.

III. Methods of Application

The simplest way to test the coating on a curved surface is to cut through it with a fine, flat file, for example a No. 6 file. The most important precaution is to make sure that the file does not "rock," that is, the cut must be made in a plane. For an article like a spoon, this condition can be met by rubbing the bowl of the spoon on the file while the handle is kept from turning. In general, rocking can be prevented by holding the article in a vise, and having a rigid support a few inches away upon which the file rests while it is moved across the surface to be tested.

The filing is continued until the base metal is just exposed. If the width of exposed base metal is not more than about 10 per cent of the width of the cut, it is not necessary to make any correction for it. If the contrast between the coating and base metal is not sharp, it can be increased by treating the cut surface with an appropriate reagent. If, for example, a neutral saturated solution of copper sulphate is applied to exposed steel, it produces a film of copper on the steel and makes a sharp contrast with a nickel coating. When the base metal is copper, brass or nickel-brass ("nickel-silver"), it should be slightly etched with a solution of chromic acid and sulphuric acid, which increases the contrast.

The best way to cut through a coating on a nearly flat surface is with a precision grinding wheel, such as is available in many machine shops. If the base metal is steel, the object may be held on a magnetic chuck. Otherwise a mechanical clamp must be used to hold it rigidly. If the wheel is brought down so as to just cut into the surface, and the latter is then moved parallel to axis of the wheel, a cut with parallel edges, like that in Fig. 3A, is produced. If then the base metal is not exposed, the wheel is lowered slightly and another cut made, until finally the base metal is exposed, as in Fig. 3B.

Practically, most "flat" surfaces, especially on cast metals, are not perfectly plane, and a cut like that in Fig. 3C may be produced. If a nearly flat surface is slightly tilted, for example by putting a sheet of paper under one edge, the cut tapers, as in Fig. 3D. In such a cut, the width, C, where the base metal is just exposed, is used to calculate the thickness, according to the above formula. If the cut is like that in 3C, the thickness can be computed from the width wherever the base metal is just exposed. If, as in Fig. 3E and Fig. 4, a composite coating is tested, the thickness of each layer can be computed from the width of cut where the next lower layer is just exposed.

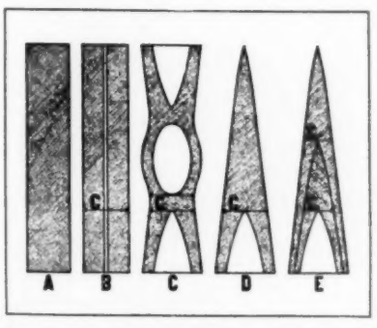


Fig. 3. Appearance of Typical Cuts with a Wheel on a Flat Surface

A—Parallel Cut That Has Not Exposed the Base Metal.
B—Parallel Cut With Slight Exposure of Base Metal.
C—Cut Produced on a Surface That is Not Quite Plane, Exposing Base Metal at Intervals. The Thickness "T" Can Be Computed from the Chord Width "C" Wherever the Base is Just Exposed.
D—Tapered Cut Produced by Slightly Inclining the Plate.
E—Tapered Cut on Plate With a Composite Coating. The Thickness of Each Coating May Be Computed from the Chord Width Where the Next Lower Layer is Just Exposed.

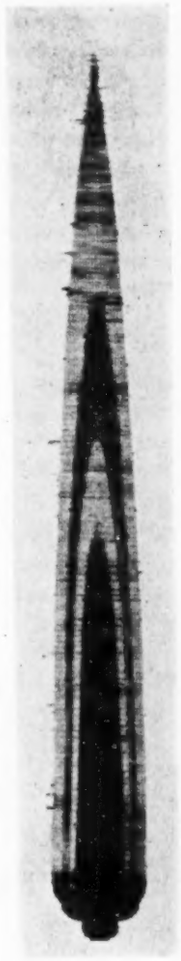


Fig. 4. Actual Cut on a Composite Nickel-Copper-Nickel Coating on Steel. The Inside Dark Area is Steel (Coated with Copper) and the Next Dark Area is the Intermediate Copper Layer

It was found that for testing coatings on hard metals such as steel, a fairly fine grinding wheel, about a 120-grain, is most satisfactory. For softer base metals, or for coatings containing a layer of copper, a coarser wheel, about a 90-grain, is preferable. The wheel should run at a high speed, around 3000 rpm. and must be dressed with a diamond occasionally to keep it true. Small changes in radius caused by this dressing are not important, but the radius should be measured often enough to know its value within say 2 per cent (that is 0.1 inch in a radius of 5 inches).

It is not necessary to use a microscope to measure the width of cut, which, for most cases to which the method is applicable, will be between 0.1 and 0.3 inch. A pocket lens and a thin steel scale, graduated to 0.01 inch, will usually be satisfactory. A combination of lens and scale, as shown in Fig. 5, is convenient. (If the graduations are in millimeters, the measurements can be converted to inches by multiplying by 0.04 or dividing by 25).

It is not always possible to measure the radius of curvature accurately, especially on an article of irregular shape, where the radius varies at different

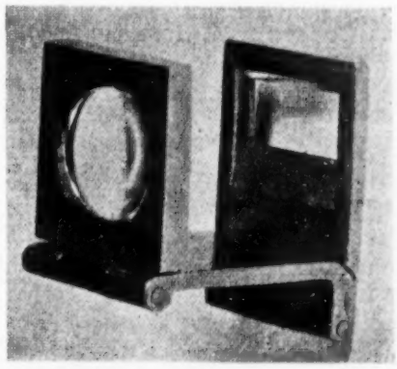


Fig. 5. Pocket Lens and Scale (Usually Metric)

parts. A radius up to 1 inch can usually be measured with a "radius gage," sets of which are available in most machine shops. In other cases templates can be prepared, such as were employed by Mesle for measuring the curvature of spoons. The most general method for measuring the curvature of any surface is by the use of a spherometer, one type of which is shown in Fig. 6. It is possible to have the dials graduated to read directly the radius of curvature. If not, the latter can be computed from the reading, which is usually in thousandths of an inch.

IV. Accuracy of the Results

The reliability of the chord method was determined by comparing its results with the average thicknesses computed from the weights of deposit on specimens plated with special precautions to produce uniform distribution. In addition, the thickness on some of the specimens was determined by measurement of metallographic cross-sections. Many of the flat specimens were taken from those plated for the exposure tests on steel or for the new exposure tests on nonferrous metals. In fact, this method has proved very useful as an additional check on the thickness and distribution of these coatings.

The conclusion from a large number of tests was that the method is almost always accurate to about 10 per cent on coatings not less than 0.0002 inch thick. The tests included nickel and composite copper and nickel coatings on steel; zinc and cadmium on steel; nickel and chromium on copper and brass; and nickel on zinc-base die castings; and silver on nickel-brass teaspoons. The results on spheres and cylinders were nearly as accurate as on flat surfaces. The method is not applicable to the very thin coatings of chromium, about 0.00002 inch, that are applied over nickel.

V. Conclusion

It is believed that the chord method is sufficiently promising to warrant its thorough trial, both within the plant to check the plating cycles, and by purchasing officers to check deliveries of plated materials. It is hoped that such tests will be made by many persons, in order to find out whether the method warrants inclusion in formal specifications.

The method is very simple and rapid, and should be especially useful when a large number of similar samples are to be tested. One of its advantages, particularly within the shop, is that in the testing, the base metal is not usually damaged much. Hence the tested articles can frequently be salvaged by stripping, polishing, and replating. This method is therefore promising for large articles, like bumpers.

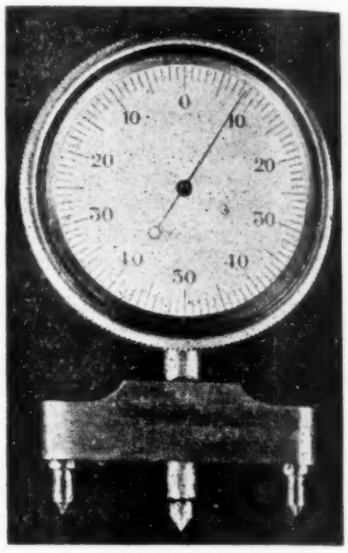


Fig. 6. Typical Spherometer for Measuring Curvatures of Surfaces

The authors desire to thank **F. C. Mesle** of Oneida Community, and **C. Kasper** and **P. W. C. Strausser** of the National Bureau of Standards, for advice and assistance during this investigation.

Thermal Expansion of Copper-Beryllium Alloys*

AN investigation of copper-beryllium alloys which have come into industrial use during the past few years was undertaken to determine the effects of chemical composition and treatments on expansion. The beryllium contents ranged from 1.3 to 3.0 per cent, results previously obtained on other properties having indicated that this range included the useful alloys. The results are set forth in detail in RP890 in the June number of the Journal of Research.

1. The expansion curves of quenched copper-beryllium alloys containing 1.33 and 2.14 per cent of beryllium showed critical regions which may be associated with structural changes accompanying aging.

2. Stabilization of copper-beryllium alloys may be accomplished either by tempering or by cold-working.

3. There is no simple relation between the coefficients of expansion, chemical composition, and heat treatment of the copper-beryllium alloys investigated. Figure 14 of the publication indicates the effects of beryllium content, cold-work, and heat treatment on the coefficients of expansion of these alloys.

4. The following table gives the ranges of the coefficients of expansion:

Beryllium content %	Average coefficients of expansion[1] per degree C 20 to 100° C $\times 10^{-6}$	20 to 200° C $\times 10^{-6}$	20 to 300° C $\times 10^{-6}$
0.00	16.8(2)	17.2-17.3(2)	17.6-17.8(2)
1.33	16.4-17.0(14)	15.9-17.3(11)	17.3-18.1(8)
2.14	16.5-16.7(9)	16.6-17.1(8)	17.5-18.0(7)
3.03	15.9-17.3(6)	16.0-16.9(4)	16.4-17.4(4)

[1]This table does not include coefficients of expansion for temperature ranges in which critical regions were observed. Each number in parentheses represents the number of expansion determinations.

The coefficients of expansion of the copper-beryllium alloys do not differ from the corresponding value for copper by more than 8 per cent of the latter value, whereas differences for the hardness, tensile strength, elongation, and reduction of area, as shown in figure 8 of the publication, are considerably greater. For example, the tensile strength of copper-beryllium alloys may be more than four times as great as the tensile strength of copper.

5. The changes in length, density, and volume noted for both the quenched and the hard-drawn alloys are somewhat larger than the small changes noted for the aged alloys. The changes in length, volume and density of quenched copper-beryllium alloys depend upon the temperature and time of aging. The density of copper-beryllium alloys decreases with increase of beryllium.

*From the Technical News Bulletin of The National Bureau of Standards, Washington, D. C.

Metal Rectifiers to Supply Current for Plating

By A. SMART
Electrodepositors' Technical Society, London, England.

Metal Rectifiers Are in Some Situations an Accepted Type of Equipment for This Purpose.*

THERE are four types of rectifiers which have been applied commercially. They are:— (1) The rotary commutator. (2) The valve rectifier. (3) The mercury arc. (4) The metal rectifier.

The rotary commutator has been applied to a limited degree to electroplating work. This type of rectifier has little, if any, advantage over the motor generator; in fact, it would seem likely that when dealing with very heavy currents, additional trouble would be experienced with commutators and brushes. The mercury arc and valve types of rectifier are fundamentally unsuitable at present, owing to their inherent electrical characteristics.

The voltage drop in a mercury arc rectifier is approximately 18 volts at all loads; this would reduce the overall efficiency of a 6-volt equipment to something less than 25 per cent. The initial cost would also be very high. The valve rectifier in addition to having a very low efficiency for such current outputs would cost prohibitive sums for replacement valves, as it must be remembered that the life of this rectifier is relatively short.

The metal rectifier, however, presents very considerable possibilities as a source of power for electroplating, and the development and exploitation of this rectifier have now proceeded to a point when it must be considered as an accepted method of power supply.

Theoretical Principle of the Metal Rectifier

The development of the metal rectifier commenced with the realization that if a film of certain metallic compounds was formed on the surface of a metal, the junction so formed had peculiar electrical characteristics in so far as it offered a high resistance to the passage of an electrical current in one direction, and a low resistance in the opposite direction. For the commercial application of this principle, a film of cuprous oxide on copper has many advantages. Rectifiers employing electrical constituents, such as the aluminium, ammonium phosphate rectifier, have been known for many years. The operation of rectifiers of this kind is coupled with a chemical change of the constituents. The value of the metal rectifier lies in the fact that its rectifying action is entirely electronic, and no chemical change in the constituent parts takes place.

Construction of Metal Rectifiers

The construction of a metal rectifier plating equipment consists of the engineering application of this principle. Two forms of construction of the rectifier elements are employed. They are:

1. The washer type.
2. The plate type.

Rectifiers of the washer type are made by stamping from sheet copper discs with holes in the centres. The largest washer which is used is approximately 1⅝ ins. in diameter with a 9/16 in. diameter hole in the centre. The washers are then oxidized on one side only. The oxide surface is very hard, and contact is obtained by interleaving lead washers between the rectifier washers. A number of rectifier and lead washers are mounted on a spindle with fins for cooling purposes. Spacing washers are employed for keeping the cooling fins apart. The whole unit is subjected to pressure by bolting up with spring washers.

The washer type of unit is used for relatively low currents, while for large currents the plate form of assembly is employed. Plate type rectifiers are made from strips of copper approximately 12 in. long and 3 in. wide. The plates are oxidized on both sides, and the oxide surface is sprayed with metal. Spring clips along the edges of the plates serve to conduct the current to the oxide film. Contact is made to the copper by removing a small area of the oxide at one end of the plate.

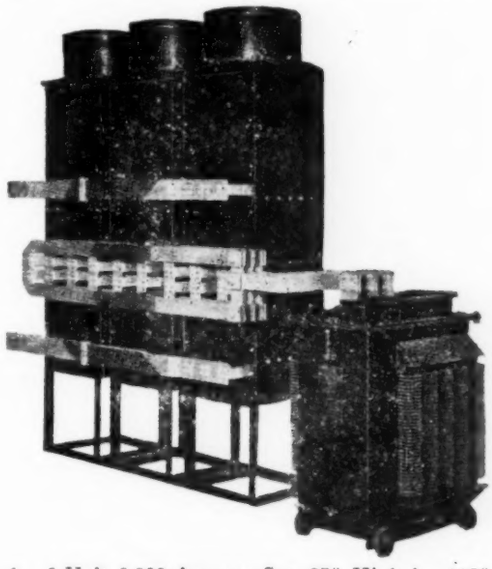


Fig. 1. 6-Volt 3,000-Ampere Set, 97" High by 118" Long by Max. Width 33"

*From a Paper read at a meeting of the Electrodepositors' Technical Society, (England), March 18, 1936.

The power which can be rectified with any element is governed by the temperature rise of the element under the worst load conditions, and the rating can be increased with safety if greater power can be dissipated without additional temperature rise. It is for this reason that with the larger rectifiers fan cooling is employed.

Fan cooling is not practical on rectifiers of small outputs, as the cost of the fan exceeds the saving in cost which can be made in the rectifiers.

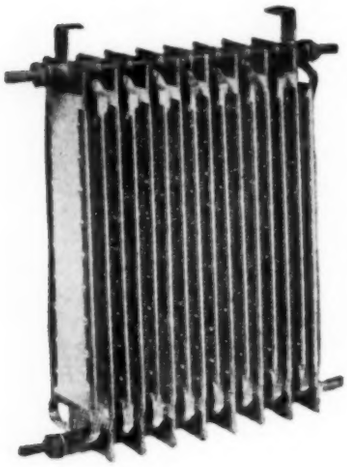


Fig. 2. Plating Assembly Used for High Currents at Low Voltages

It is usual, therefore, to employ the washer type units which rely on the natural conversion of currents of air through their cooling fins in the rectifiers of small outputs, while fan-cooled plate assemblies are used for outputs exceeding approximately 1·5 KVA.

Each rectifier element has a maximum voltage which it will withstand, and a maximum current which may be taken from it. Rectifier elements are connected in series or parallel arrangements according to the direct current output which is required.

A single rectifier element gives what is known as half-wave rectification, **i.e.,** when the polarity of the alternating current supply is in one direction current passes through the rectifier; when the polarity is reversed no current flows. The circuit to which the rectifier is connected therefore experiences successive pulses of undirectional current. The half-wave circuit is rarely used in practice. Full-wave rectification is obtained by means of a bridge circuit, and both positive and negative half-cycles of the alternating current supply are used. The output of the three-phase bridge circuit which is normally used for electroplating rectifiers is equivalent to a direct current supply with a 15 per cent voltage ripple superimposed upon it. It may be stated that it has not been possible to trace any effect whatsoever on any electrochemical process caused by the ripple in the output voltage of the rectifier, even when single-phase rectifiers are used. It may, in the absence of any evidence either theoretical or practical to the contrary, be assumed that voltage ripple has no adverse effect.

As the process of rectification is entirely static, and is not accompanied by any chemical change in the rectifier elements, it will be appreciated that a very long useful life may be anticipated. In practice, it is found that a small drop in the rectifier output will be observed during the first year or so of use, after which no appreciable change takes place for a considerable period.

In designing a plating equipment, allowance is made for this initial aging, and the output of the rectifier may be restored to its original figure after it has taken place.

A metal rectifier plating equipment consists of three principal parts:

1. The transformer.
2. The rectifier.
3. The control gear.

The transformer is a familiar piece of electrical equipment which is so widely used that no reference need be made to its method of operation. The majority of transformers which are employed have a primary winding suitable for 400/440 volts three-phase and a secondary giving an output of the order of six volts at a high current. The transformers are designed so as to reduce to a minimum losses which might result from carrying very high currents at low voltages in the secondary windings.

The principal loss which must be guarded against is that due to stray flux in the region of heavy current conductors. Transformers are designed so that the secondary connections are close together and the alternating current bus-bars between the transformer and the rectifier ducts are kept as close to each other as possible. When very heavy current outputs are required, it is usual to employ a transformer with two or more secondaries. This practice limits the size of the alternating current bars, and consequently enables the conductors to be closely grouped.

The secondary voltage of the transformer approximates to the voltage which is required at the direct current side of the rectifier. Connection is made from the transformer direct to the rectifier.

As has already been indicated, the majority of plating equipments employ fan-cooled plate type elements. The rectifier elements are mounted together in ducts constructed from angle iron and sheet steel. Several standard sizes of duct are employed. The largest, which is approximately 8 ft. by 2 ft. by 2 ft., contains a rectifier capable of giving an output of 6 volts and 1,000 amps. Higher outputs are obtained by using two or more ducts connected in series or parallel.

Individual rectifier elements are connected together in banks inside the duct, and connection is made to each rectifier bank by short bars passing through one side of the duct, which are connected to the main bus-bars.

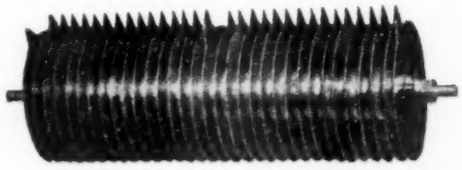


Fig. 3. Washer Assembly Used for Low Currents at High Voltages and for Small Outputs

Each duct is equipped with a small fan which draws a supply of air for cooling purposes upwards through the rectifier plates.

Safety Devices

In the design of an electroplating equipment, it is necessary to incorporate suitable devices for protecting the equipment against damage caused by very heavy overload or failure of the cooling fans. This protection is achieved by the design of a suitable control circuit. Each fan is equipped with a centrifugal relay which makes an electrical contact only when

the fan is rotating at full speed. The fan contacts are connected in series with the exciting coil of a contactor which connects the alternating current supply to the primary windings of the transformer. The equipment is started by a push-button switch in parallel with the fan contacts.

On closing this push-button, the main contactor is excited and closes, starting up the fans and connecting the transformer to the mains. When the fans reach full speed, the centrifugal relays close, and the push-button may be released. A further push-button in series with the contactor coils when operated breaks the circuit of the contactor coil, thereby switching off the equipment. The contactor also incorporates overload trips which protect the equipment from damage in the event of a sudden heavy overload.

The equipment, the design of which has been considered so far, is suitable for giving a constant voltage output, and can be employed without modification in certain electrochemical processes where the control of the current is not critical. Under certain circumstances, however, it is desirable or necessary to control the current output from a rectifier. There are three principal methods of obtaining current control, by—

1. Series resistances,
2. Transformer tappings,
3. A moving coil regulator.

The most popular method of current control in the electroplating shop is the resistance board, and a resistance board may be used in conjunction with a rectifier in exactly the same way in which it is employed when used with a dynamo. The constant dissipation of power in the resistances makes it desirable to install more efficient control apparatus, where large power outputs are concerned. Transformer tappings provide an efficient alternative. In view of the fact that the transformer secondary is designed to give very high current outputs, it is impossible to provide secondary tappings and primary tapping must as a consequence be employed.

Methods of Output Control

It is usual on all rectifiers to provide a range of primary tappings which allow adjustments in the output to be made during off-load periods. An on-load transformer tapping switch which allows adjustments to be made under load conditions without interrupting the current is fitted when variation under load is desirable. It will be appreciated that in order to decrease the secondary voltage, it is necessary to increase the number of turns on the transformer primary winding, and there is obviously a limit to the increase which can be made. In practice, it is found that control can be obtained down to approximately half full-load output. If a greater range of control is necessary an auto-transformer will have to be employed; under these circumstances the tap changing is performed on the auto-transformer, and the output may be reduced to any desired figure.

The moving coil regulator provides an alternative method of current control. The advantage of this system is that it provides an absolutely continuous variation in the current output. This equipment, which from some points of view is the most desirable, is however the most expensive.

The type of control which is employed in any particular case is dependent upon the conditions of operation. The practical application of these principles may perhaps best be demonstrated by taking the case of a general plating-shop in which a variety of metals is to be plated.

The most efficient electrical operation is obtained when resistance boards are entirely eliminated, that is to say, when every vat in the shop is equipped with a separate rectifier, control being obtained when necessary by the aid of transformer tappings.

A separate rectifier for each vat generally means, however, the maximum initial cost for the rectifying equipment. It is, in practice, necessary to arrive at a compromise, and such a compromise may be defined as the condition when the saving effected in power consumption by the further sub-division of the rectifier equipment would not provide adequate return on the additional capital invested.

A plating-shop having the following current requirements may be taken as an illustration of this principle:—

Cadmium	2 volts	200 amperes
Nickel	3 volts	300 amperes
Chromium	6 volts	1,000 amperes

This shop may be equipped in three ways:—

(a) One rectifier for providing the current for all three vats when the approximate capital cost would be £276, and the annual power cost at 1d. per unit, £125.

(b) One rectifier for the chromium and one for the nickel and cadmium together. The approximate cost would be £299, and the annual power cost £104. In this case, the additional expenditure of £23 in capital cost shows a saving of £21 per annum, and is consequently fully justifiable.

(c) One rectifier for each vat, in which case the approximate capital cost would be £332 10s., and the annual power cost £102. The extra capital cost of £33 10s. in this case only shows an annual saving of £2 per annum, and it is probable that the second case affords the most satisfactory capital investment.

These figures are intended only as an illustration of the manner in which rectifiers should be selected.

The control equipment which is included will be dependent upon the rectifiers which are selected. If in the example which has been given the second arrangement is chosen, the chromium plating rectifier would in all probability be fitted with an on-load tapping switch. As the nickel and cadmium vats are both operating from the same rectifier, an on-load tapping switch has no value, and resistance boards would be used in conjunction with each vat. Off-load transformer tappings would be fitted to the transformer to enable the rectifier output to be adjusted when first installed.

Automatic voltage control may be obtained by the aid of a moving coil voltage regulator, which can be made to keep a constant voltage at the vat terminals, irrespective of fluctuations in the load and in the mains voltage. General plating practice does not, however, call for such refinements, which may, however, have some application in the plating of precious metals.

The characteristics of a complete equipment are dependent in some degree upon the voltage output which is required. For three-phase bridge connection, the optimum output voltage is six on multiples of six volts. It would appear that this voltage is adequate for all electroplating processes with the exception of barrelling, cleaning and stripping.

The overall efficiency of an electroplating equipment working at optimum voltage is in the order of 75

per cent to 80 per cent. This efficiency is maintained down to about 20 per cent full load. It will be found in practice that, with the exception of plant used for mass-production processes, the load in any vat varies greatly during the day. In fact, the average current requirement during any typical working day rarely exceeds 50 per cent to 60 per cent of the maximum. The high efficiency of the rectifier at light loads results in a considerable saving in power consumption in comparison with alternative methods of current supply.

The voltage regulation of an equipment is approximately 25 per cent between no load and full load.

The power factor, except at very light load, is usually between 0·9 and 0·95. This power factor is considerably better than can be expected from a motor-generator, and any financial comparison between the metal rectifier and the motor generator must take into account the capital cost of condensers or other similar equipment for power factor improvement of the motor-generator.

The conditions existing in a plating-shop play a large part in determining the manner in which a rectifier shall be installed. The electrifier plates are protected against corrosion by acid fumes, but as with all electrical equipment a clean atmosphere is desirable. If the conditions which exist in a plating-shop are so bad as to be likely to lead to damage to the equipment, the rectifier should be mounted in some other part of the building, or alternatively supplied with fresh air drawn from outside. A rectifier, which is practically silent in operation and which has no moving parts other than the cooling fans, may be installed in positions where it would be undesirable to place a motor-generator.

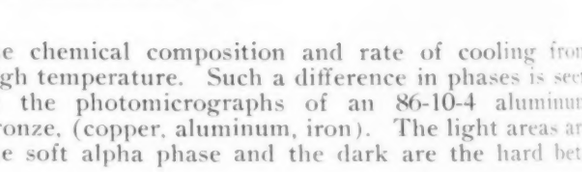
The final criterion for the judgment of any form of equipment must be the effect which its employment has upon the costs of the processes to which it is to be applied. The initial cost of the equipment is interesting only as one of the factors in determining this cost. As a true comparison in the costs of motor generators and rectifiers can only be made by a full consideration of every item, it will be obvious that no generalization which will cover all possible circumstances can be made. As a general guide, it may be said, however, that in initial cost, the rectifier is higher than the motor-generator. There is, however, a reduction in operating costs which, under the majority of circumstances, make its installation justifiable. In the past, very little regard seems to have been paid to the electrical efficiency of plating shops, and it is not unusual to find that of the total power consumed from the electricity mains, not more than 20 per cent is usefully employed in the vats. It will be found under such circumstances that the cost of replacing the generating equipment by rectifiers will show a substantial return on the capital expenditure.

Metals and Their Structure*

ALL metals and alloys are crystalline from the time they pass from a liquid to a solid state. It is an inherent property and one of the distinguishing characteristics that differentiates metals from most non-metals. Twenty years ago metallurgists in general believed in the presence of some amorphous (non-crystalline) material along the crystal boundaries, but the X-ray has disproved its existence conclusively.

The properties of metals are largely influenced by size, shape and orientation of its crystals. We are familiar with the dendrites found in cast metals and which exist in shrink cavities. If they are large and extend perpendicularly from the cooling edge for some distance, the alloy is sure to have properties which are inferior to the same alloy with smaller crystals.

We often hear that the cause of a failure in service is "crystallized metal." This is an erroneous term. There are only two ways in which metals can recrystallize; namely, (1) Cold deformation above the elastic limit (rolling, hammering, etc.), followed by heating to some critical temperature, and (2) The metal changes from one solid state to another. It is with this second type that most foundrymen come in contact. Excellent examples of this are the high zinc brasses, high tin bronzes and high aluminum bronzes. Each one of these alloys will have at least two different "phases" present, consisting of a different type of crystal. Naturally, such a difference in crystals will have an effect upon the properties of the metal. One "phase" is soft and ductile, while the other is hard, strong and usually brittle at room temperature. The proportion of these phases and hence the type of properties obtained are dependent upon the chemical composition and rate of cooling from high temperature. Such a difference in phases is seen in the photomicrographs of an 86-10-4 aluminum bronze, (copper, aluminum, iron). The light areas are the soft alpha phase and the dark are the hard beta (or iron rich) phases. It is these latter crystals that give the hardness and strength, but decreased ductility to the alloy. The right hand photomicrograph is taken at 1,000 diameters making it possible to see the nature of the structure more clearly. The small black spots showing in the alpha (light) crystals are a separate iron rich phase.



Photomicrographs of 88 Cu, 10 Al, 4 Fe Bronze

*From Kramer Alloy News, No. 5.

Prizes for Exhibits

At the platers' convention in our June issue, page 208, we reported that **W. D. Scott** of the Cleveland Branch had won the second prize for individual exhibits, and **J. P. Sexton** of the Bridgeport Branch had won the third prize. This was an error. The second prize was awarded to **J. P. Sexton** and the third prize to **W. D. Scott.**

Editorial Comment

Tubal Cain Outdistanced

THE recent broadcast of the American Chemical Society delivered by **Professor Robert S. Williams** summarized briefly the most important modern developments in non-ferrous metallurgy. In the necessarily short time allotted to a radio speaker, he could not even mention every improvement, but dwelt on aluminum, copper, nickel, magnesium and one or two special alloys including Duralumin, Dowmetal, beryllium bronze, Monel metal, carboloy and the lead compounds containing barium, calcium or sodium. Since his talk was confined to non-ferrous metals he did not mention Columbium, formerly a laboratory curiosity but now a widely used commercial product because the uses of Columbium are still restricted to alloy steels. However, we may hear something about it in the non-ferrous field one of these days.

So — we keep thinking as we receive our usual quota of announcements from inspired ex-blacksmiths that they have discovered Tubal Cain's secret of tempering copper, that very likely they have. A few impurities and a fair amount of cold work will do "wonders". Tubal Cain was a great practical artificer in metals. Probably, if he were living today he would rank as one of the foremost metal workers in our time, as he did in his own day. But so far as results are concerned, compared to the products of modern research and organization, he was an amateur alloyer.

The world do move!

Machinery vs. Employment

AFTER years of controversy about how much machinery has contributed to unemployment and after millions of words by orators, agitators, would-be statisticians, etc., showing that eventually machines would do everything and human beings would do nothing, we have before us a concise booklet issued by the Machinery and Allied Products Institute, entitled, "Ten Facts on Technology and Employment." These Facts are backed by statistics, too long to quote here, but the conclusions given below speak for themselves:

1. Jobs have increased faster than population between 1870 and 1930.
2. Employment at this time is nearest to normal in the most highly mechanized industries.
3. Eighteen new industries resulting from machinery development have created millions of new jobs.
4. Growing occupations add three new workers while vanishing occupations lose one.
5. Less than 4% of the 2½ million unemployed studied in the Federal Unemployment census of April, 1930, reported that they had lost their jobs by displacement by machines.
6. Eighty-four per cent of all machines are "labor serving" rather than "labor saving".
7. Workers are in increased demand where most machines are installed.
8. Machinery has raised labor's earning power.
9. A higher standard of living is attainable only through increased production by the use of machinery.
10. Our 1929 production level should be raised 75% to provide a "reasonable" standard of living for every family in the United States.

We wait for the "anti-machine" exponents to answer these statements.

A Worth While War

A MERRY free-for-all battle is in progress between metals, steel, non-ferrous, heavy and light; also between metals and non-metals. Aluminum and stainless steel are intent upon the new business in light weight, high speed railroad cars. Aluminum is making inroads into the automobile body field, even in the chassis. Magnesium is gaining steadily in motor cars, trucks and buses.

As between metals and non-metals we are witnessing a fight between tin cans and glass for beer containers; between metal foil and transparent cellulose for wrapping food products; between cast metal and plastics in a thousand different novelty and other products.

These battles are all parts of a great war which will never end. The winners will be the best products, most ably handled; the losers, the weak sisters, who are lacking in intrinsic worth or in ability to present their case. The ultimate beneficiaries are the public.

The Art of the Machine Age

THE antagonism between the artist and the industrialist has long been proverbial. The artist is a simple-minded genius with his head in the clouds; the industrialist a crass, coarse materialist—"and never shall the twain meet". But these are queer times. The rules are being changed and art and industry are beginning to work together.

An exhibition was recently held at the Art Museum in Worcester, Mass., entitled "Art of the Machine Age: the Challenge of Mass Production," consisted of Worcester products, which proved conclusively that art and industry are not incompatible. Exhibits consisted of such earthy products as firearms, grinding wheels, rolling mill bearings, tool sharpening machines, circular saws and micrometers, to say nothing of consumer goods like kitchenware, automobile and bicycle equipment and razors.

There is no inevitable quarrel between art and industry. There is no gulf of separation. Industrial products have been ugly because of inertia and carelessness. Any product can be designed for beauty without sacrificing utility, and industry is growing more conscious of the fact that good design adds to saleability.

Correspondence and Discussion

Rhodium Plating Solutions

To the Editor of **Metal Industry**:

We have received our copy of the 1936 edition of the "Platers' Guidebook" and have found it as usual, most instructive.

Your article on Rhodium, which is of particular interest to us, ends with the following statement: "The basic patents on rhodium plating solutions are held by Baker & Co., Inc., 54 Austin Street, Newark, N. J."

This statement is, of course, true. However, it might leave your readers under the impression that the only place Rhodium can be purchased is from Baker & Co., Inc. As a matter of fact we have been licensed by Baker & Co., Inc., under their patents and can supply rhodium solution to your readers anywhere in the United States and Canada.

We hope you will advise your readers of the above.

SIGMUND COHN.

New York, N. Y.
June 22, 1936.

New Books

Year Book of the American Bureau of Metal Statistics. Published by the American Bureau of Metal Statistics, 33 Rector Street, New York. Size 8 x 10½; 118 pages. Price, to non-members, $2.00.

This is the 16th annual issue (1935) of this standard and authoritative compilation of statistics on non-ferrous metals. The statistics cover production, consumption, imports, exports, etc., of copper, lead, zinc, gold, silver and a number of miscellaneous metals, such as platinum, antimony, arsenic, cadmium, nickel, tin, aluminum, cobalt, etc.

Cost Report of the Master Electro-Platers' Institute of the U. S. Published by the Master Electro-Platers' Institute, 7320 Hamilton Avenue, Detroit, Mich. Size 9 x 11½; about 50 pages; bound in a stapled loose leaf folder. Price $2.00.

This collection of forms is the result of the efforts put forth by the Master Electro-Platers' Association of the Mid-West for the purpose of arriving at a simple plan of analyzing plating costs to lead the industry to more uniform methods of estimating and quoting. It is the object also to assist the small shop in determining its actual costs without the installation of an expensive system.

The folder contains an introduction to analysis of labor, materials and burden costs; estimating sheet; quotation sheet; six sets of monthly forms entitled, "Labor, Materials and Burden Costs"; a convenient annual or quarterly expense analysis sheet, entitled, "Cost Data", compiled from 1935 accounts; key to efficiency analysis chart; six forms to record industrial compensation experience.

The Master Electroplaters' Institute has done pioneer work in the collection and analyses of cost accounting methods in the plating shop. The problem is extraordinarily difficult, out of all proportion to the average size of the shops in the job plating industry. It is fortunate, however, that there is an organization actively and courageously engaged on this problem. This folder will be a valuable aid to all plating shops (and departments) who are seriously attempting to standardize their operations.

Traffic Dictionary, by C. S. Nelson and George T. Stufflebeam. Size 4½ x 6; 224 pages. Price $1.25. A compact, handy, sturdily bound booklet giving the definitions of all of the terms used in phrases and abbreviations used in domestic and foreign trade shipping. A useful booklet for the shipping department and also for any manufacturer or business man faced with complicated directions for shipment from his customers.

Work Shop Receipts. Published by Chemical Publishing Company. Size 5 x 7; 458 pages. Price $2.50.

The book described here is the Supplement to a set which includes four volumes in addition. The whole set is an encyclopedia of formulae, practical methods, processes, manipulations, etc., the Supplement being a condensed appendix purporting to cover as much of the field as possible within two covers. Among the subjects discussed are: aluminum; bearings; brass; cutting metals; lacquering; lead burning; metal finishes; spray painting; soldering, etc.

Glances at Industrial Research, by E. R. Weidlein and Wm. A. Hamor. Published by Reinhold Publishing Company. Size 5 x 7, 235 pages; price $2.75.

This is a notable little popular book, giving a comprehensive, compact and readable account of the recent advances, present status and future opportunities of industrial research. The fact that it is authoritative is shown by the positions of the authors who are director and assistant director, respectively, of the Mellon Institute of Industrial Research, Pittsburgh, Pa. Written especially for business men, the book tells of the value of scientific research in creating new products and processes and improving present commodities and their methods of manufacturing.

Government Publications

Tungsten Industry in 1935—Advance Summary, U. S. Bureau of Mines, Washington, D. C.

Molybdenum Industry in 1935—Advance Summary. U. S. Bureau of Mines, Washington, D. C.

Simplified Practice Recommendation for Tinned Steel Ice Cream Cans; approved by the Industry. Division of Simplified Practice, National Bureau of Standards, Washington, D. C.

Lead. By E. W. Pehrson and H. M. Meyer. Chapter from Minerals Yearbook 1935. Bureau of Mines, U. S. Department of Interior. For sale by the Superintendent of Documents, Washington, D. C. 5 cents.

Magnesium Industry in 1935. Advance Summary. U. S. Bureau of Mines, Washington, D. C.

Cadmium Industry in 1935. Advance Summary. U. S. Bureau of Mines, Washington, D. C.

Abrasive Grain Sizes. Revised Simplied Practice Recommendation R118-30. Division of Simplified Practice, National Bureau of Standards, Washington, D. C.

Lead Industry in 1935—Advance Summary. U. S. Bureau of Mines, Washington, D. C.

Copper Industry in 1935—Advance Summary. U. S. Bureau of Mines, Washington, D. C.

Mercury Industry in 1935—Advance Summary. U. S. Bureau of Mines, Washington, D. C.

World Chemical Developments in 1935. Trade Information Bulletin No. 832. Bureau of Foreign and Domestic Commerce. For sale by the Superintendent of Document, Washington, D. C. Price 15 cents.

Technical Publications

Research on Thin Layers of Tin and Other Metals II. The Corrosion of Metals by Technical Insulating Oils, by P. J. Haringhuizen and D. A. Was. International Tin Research and Development Council, 149 Broadway, N. Y.

Methods of Detinning Tinplate for Examination of the Thickness and Continuity of the Alloy Layer, by A. W. Hothersall, and W. N. Bradshaw. International Tin Research and Development Council, 149 Broadway, New York.

A Study of the Origin of Porosity in the Tin Coating of Tinplate, by A. W. Hothersall and J. C. Prytherach. International Research and Development Council, 149 Broadway, New York.

The Creep of Tin and Tin Alloys, Part 1, by Professor D. Hanson and E. J. Sanford. International Tin Research and Development Council, 149 Broadway, New York.

Shop Problems

This Department Will Answer Questions Relating to Shop Practice

METALLURGICAL, FOUNDRY, ROLLING MILL, MECHANICAL, ELECTRO-PLATING, POLISHING, AND METAL FINISHING

Associate Editors

H. M. ST. JOHN
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Contaminated Nickel Solution

Q.—We experience trouble with our nickel plating solutions every time we filter them. The first few batches of work plated after the solution has been filtered will be black around the edges. Under separate cover we are sending a couple of samples of the plated work and also a sample of the solution in which these pieces were plated. The only time we have this trouble is immediately after solutions are filtered. We use a filter press which is lead lined and a bronze pump.

We also have trouble with our nickel blistering and peeling on the flat sides of hardened screw driver blades. This is the only piece we plate on which we have this trouble and this blistering only occurs on the ground flat sides of the blades and never on the shanks. The plating solution used is of the same analyses as the sample submitted and plating is done at room temperature. A few screw drivers are also being sent.

A.—There is evidently some condition which exists in your filtering operation that causes the solution to pick up lead, copper, or some other element in the filter materials.

Suggest you take the pump apart to see if the bronze is being attacked in some way. Ordinarily a bronze pump is suitable for a nickel solution. You may have a short circuit condition or an unsuitable bronze alloy. Dissolving lead from the frames will also contribute to this trouble. Suggest you be sure the filter press is cleaned out well after each operation so that salts left in the press will not cause chemical attack of the metal parts and then carry the impurities into the solution when filter is next used.

The lubricant used in grinding the flat parts of the screw driver blades may contribute to the peeling difficulty. The blades should first be cleaned in an electric cleaner, then rinsed well and pickled in muriatic acid to remove even minute traces of scale. Scale caused by the grinding operation will be a source of poor adhesion. Good pickling is necessary to remove this scale.

—G. B. H., Jr., Problem 5,507.

Contaminated Silver Solution

Q.—I am sending silver solution for analysis.

A.—The analysis of the silver solution is:

Silver	1.98 tr. ozs./gal.
Free sod. cyanide	4.65 ozs./gal.

The free cyanide is somewhat high for the metal content.

The metal could be increased to three ounces by the addition of silver cyanide.

Before recommending that any more metal be put in this solution, however, we would like to know what trouble, if any, is being experienced. From tests that have been made this solution appears to be contaminated with some foreign metal.

If this is the case, and if poor work is being obtained, it would not be advisable to put more silver in the solution. It would be better to make up a new solution and recover the metal from the old one.

—G. B. H., Jr., Problem 5,508.

Copper and Nickel Solutions

Q.—We are sending samples of cyanide copper and of nickel solution for analysis.

A.—The analysis of the cyanide copper is:

Copper	1.23 ozs./gal.
Free cyanide	2.89 ozs./gal.

The free cyanide is too high. The metal is too low.

A good copper solution may be made up from:

Copper cyanide	3.0 ozs./gal.
Sodium cyanide	4.0 ozs./gal.
Sodium carbonate	2.0 ozs./gal.

Your copper solution appears to be contaminated with some impurity. If volume of solution is not large would advise making new solution, if serious trouble is being experienced, rather than correct old solution. We have no information from you as to your problem.

The nickel solution submitted analyzes:

Nickel	1.75 ozs./gal.
Chloride	None
pH	5.9

Both metal and chloride are too low. Add 6 ozs./gal. of single nickel salts and 3 ozs./gal. of ammonium chloride. After these additions the pH should be checked. A value of 5.8 to 6.0 pH should be maintained.

—G. B. H., Jr., Problem 5,509.

Copper in Cast Iron

Q.—We desire to use copper to make iron machinable on a production basis. We are making small refrigerator and air compressor castings with the following analysis:

USE THIS BLANK FOR SOLUTION ANALYSIS INFORMATION

Fill in all items if possible.

Date.....

Name ..... Class of work being plated: .....

Address ..... Volume used: .....

Employed by: ..... Solution depth: .....

Kind of solution: ..... Cathode surface, sq. ft.: .....

Tank length: ..... width: ..... Kind of anodes: .....

Anode surface, sq. ft.: ..... Distance from cathode ..... Original formula of solution: .....

REMARKS: Describe trouble completely. Give cleaning methods employed. Send small sample of work showing defect if possible. Use separate sheet if necessary. _____

NOTE: Before taking sample of solution, bring it to proper operating level with water; stir thoroughly; take sample in 2 or 3 oz. clean bottle; label bottle with name of solution and name of sender. PACK IT PROPERLY and mail to METAL INDUSTRY, 116 John Street, New York City.

Silicon	1.95%
Manganese	0.60%
Phosphorus	0.20%
Sulphur	under 0.10%
Carbon	3.60%

Charges are made of

50%	Pig
30%	Returns and bought C. I. scrap
20%	Steel rails.

While we are supplying some iron foundries with copper, we are not familiar with the use of this metal in the manufacture of iron alloys.

Please be kind enough to advise us the benefits obtained by the use of copper, and the proper percentage to be used for the purpose our friends desire.

A.—The idea of adding copper to iron seems to be that it breaks up the graphite. It also is supposed to increase the tensile strength. Some of the large foundries are adding 1½ to 1¾% copper. If introduced properly it will also improve the machining qualities of the metal.

However, copper cannot be introduced properly in the cupola. It is best done in the holding furnace. It can be added to the ladle and should be in shot form or small equal sized pieces of copper.

At the present time we understand there is considerable experimental work being carried on in alloying copper with iron, and its effects upon cast iron.

—G. B. H., Jr., Problem 5,510.

Green-Brown on Brass

Q.—We submit a picture frame with this letter, requesting the method of obtaining the green brown color on brass, gold plated. We have tried out practically all of the recipes contained in 1935 edition of Platers' Guidebook but cannot seem to get a good smooth finish with a green brown color.

A.—A formula recommended for this finish is composed of:

Copper sulphate	4 ozs.
Potassium chlorate	8 ozs.
Water	1 gal.

Immerse and transfer without rinsing to a solution of liquid sulphur (1 oz./gal.). Repeat the operations to darken.

Scratch brush to dry.

The type of finish obtained will depend on the composition of the base metal. Thus on the frame in question it appears necessary to use a high copper brass.

—G. B. H., Jr., Problem 5,511.

Plating on Iron Bases

Q.—Will you kindly send the following information.

1. Nickel solution for plating on iron bases used for lamps; flash deposit only.

2. Brass solution for same as stated above, only that the brass deposit be heavy enough to stand oxidizing for an English Bronze Finish.

Iron bases are 10 inches in diameter.

A.—The following solutions may be used for flash deposits on iron bases as mentioned:

Double nickel salts	12 ozs./gal.
Single nickel salts	4 ozs./gal.
Ammonium chloride	2 ozs./gal.
Boric acid	2 ozs./gal.
Water	1 gal.

Temp. 70-80 deg. F.; 2-2½ volts; 6-8 amp. per sq. ft.; pH 58. 99% plus depolarized anodes. Replenish solution with single nickel salts. A commercial brightener may be used to obtain a bright deposit.

A brass solution made up as follows can be used for plating castings mentioned:

Copper cyanide	4 ozs./gal.
Zinc cyanide	1 oz./gal.
Sodium cyanide	5½ ozs./gal.
Sodium carbonate	2 ozs./gal.
Water	1 gal.
Free cyanide	1.00 to 1.50 ozs./gal.

Temp. 75-90 deg. F; cathode current density 2.5 to 5 amp. per sq. ft.; 2-3 volts; anodes, rolled annealed 80% copper and 20% zinc.

—T. H. C., Problem 5,512.

Silver Paste

Q.—Quite a few of the garages and supply houses are silvering reflectors for automobiles, with some sort of a paste which they put on and then buff. Would be glad to know the formula.

A.—A paste for silvering reflectors, that is non-poisonous, appears on page 347 of "Principles of Electroplating & Electroforming" Blum & Hogaboom.

Silver nitrate	2 parts
Ammonium chloride	1 part
Sodium thiosulphate (hypo)	4 parts
Calcium carbonate powder	4 parts

Mix with water to a paste.

The surface to which this is applied must be clean.

—G. B. H., Jr., Problem 5,513.

Refractory for Smelting Dross

Q.—What fire brick would you recommend using for the metal line in a reverberatory smelting furnace? The furnace is used for smelting solder, babbitt and terne drosses.

A.—A furnace of the reverberatory type for smelting solder, babbitt and terne drosses, should have a magnesite brick lined bottom. The same brick would be used in the side walls for at least six inches above the slag line. The remainder of the side walls and the roof should be of fire brick containing about 40% alumina.

—W. J. R., Problem 5,514.

Slush Casting

Q.—We are contemplating installing equipment for the purpose of casting white metal parts, and are writing you for possible information which you may be able to give us.

Our intentions are to make castings from slush molds with a casting pot capacity of approximately 100 pounds, and the metal we intend using is a rather hard composition composed chiefly of zinc.

We would like any instructions or information that we could gather in reference to the construction of the slush type molds for the manufacture of castings for electric floor lamps.

A.—We suggest you secure a gas or oil fired furnace of the desired capacity. Such furnaces you will find advertised in **Metal Industry.** We suggest a furnace that is so arranged that you can use an iron pot to melt or a graphite crucible. If you have a big production, we suggest a tilting type crucible melting furnace, and a holding pot furnace. Melt the metal in the crucible tilting type furnace, and transfer into the holding pot furnace, from which you pour your casting by dipping out the metal with a ladle.

From our experience with slush mold casting, the gating is very important; also the angle of pouring, the designing of the mold, and the temperature of the mold. You will save money by securing the services of a man versed in this line of work. A great deal of skill is necessary in casting this work, the handling of the mold, its proper temperature and the correct heat of the metal, and the proper venting of the mold. All these are factors influencing the character of the casting.

In producing small castings, the heat of the metal can be considerably higher because small molds cool more quickly. In large castings, the temperature must be kept uniform on account of the heat the mold retains, and it is often necessary to cool off certain parts of the mold with water, especially the gate part adjacent thereto.

The molds are usually made of bronze. The alloy used is approximately 88 copper, 10 tin, 2 zinc, and the first requisite in producing slush mold castings is a good mold with as few parts as possible. In the last 10 years slush casting has been greatly improved, such as eliminating the hot laborious method of pouring by hand and turning the heavy hot mold over to dump the surplus metal out, by forcing the molten metal into the die, same being held in a swinging die bolster attached to the machine. When the shell hardens, the surplus metal is withdrawn with the mechanism instead of turning the die over to allow the metal to run out by gravity.—W. J. R., Problem 5,515.

Tarnished Silver

Q.—We are enclosing two samples of pure silver wire which are coated with what we believe to be silver oxide and silver carbide. We would like to know how these coatings could be removed from these wires.

A.—The samples you submitted can be cleaned up by dipping in a mixture of:

Concentrated nitric acid	2 parts by vol.
Water	1 part by vol.

If the wire is oily, or greasy before dipping the action will not be uniform. Oil or grease can be removed with a solvent such as carbon tetrachloride or trichlorethylene. Follow this by immersion in an alkaline cleaner. Then apply the acid dip.

—G. B. H., Jr., Problem 5,516.

Practical Brass Foundry Digest

By H. M. ST. JOHN

Chief Metallurgist, Detroit Lubricator Company; Associate Editor, METAL INDUSTRY.

Short Abstracts of Articles of Interest to Practical Non-Ferrous Foundrymen and Metallurgists.

Corrosion Resistance of Aluminum and Standard Aluminum Base Alloys. P. Mabb. Metallurgia, Vol. 13, page 109 (Feb. 1936).

The relative advantages of aluminum-copper-zinc, aluminum-copper and aluminum-silicon alloys, as well as of the heat-treatable alloys of the duralumin class, are mentioned. The series of nickel-containing alloys, with their fine casting properties and high resistance to corrosion, is described. Aluminum-magnesium alloys, containing one to 7% magnesium, are superior to duralumin in corrosion resistance. The simple alloys with copper and with silicon corrode badly in the salt spray test. Those containing nickel and copper are better, particularly when a small percentage of titanium is added. Aluminum has a natural protective film due to superficial oxidation of its surface, more effective in the pure metal than in its alloys. The corrosion resistance of this film may be enhanced by dipping the castings in a solution containing sodium carbonate and sodium chromate or by painting the work with a paste of similar composition. The Bengough and Alumilite processes are both anodic treatments, employing chromic acid and sulphuric acid respectively as the electrolytes. The latter is superior in its higher insulating properties. Both are highly resistant to corrosion and both may be colored by dyeing.

The Science and Practice of Machining Brass. Dr. Ing. M. Kronenberg. Metal Industry (London), Vol. 48, page 179 (Feb. 7th, 1936).

An exposition, with logarithmic graphs and mathematical formulae, of the factors involved in the machining of brass castings, compared with other non-ferrous and ferrous materials. With any given material and tool the cutting pressure increases and the cutting speed decreases with increasing size of chip, but at less than an arithmetical proportion. With brass, if the chip area is increased from 0.001 sq. in. to 0.005 sq. in. the pressure increases from 0.049 tons to only 0.2 tons; with an increase from .001 to .003 the cutting speed for cast brass is reduced from 305 to 185 ft. per min. With respect to this ratio between cutting speed and chip size, cast brass is more sensitive than steel or cast iron, less so than wrought brass much less sensitive than elektron (a magnesium alloy). In general, tool wear varies according to the sixth power of cutting speed. For the practical man a diagram is given showing tool life at different cutting speeds for chips of varying size. A number of examples are worked out in practical detail.

Light Alloy Practice. Maurice Cook et al. Metal Industry (London), Vol. 48, page 187 (Feb. 7th, 1936).

A discussion of Warrington's paper (See abstract above). Mention is made of a solder, melting at 200° C (392° F), for use with light alloys, having a composition of 92% tin, 7.5% zinc, 0.5% lead. The best flux is a mixture of lithium chloride, ammonium chloride and potassium chloride.

The Rationale of Phase Formation in Alloys. Anon. Metal Industry (London), Vol. 48, page 203 (Feb. 14th, 1936).

A highly theoretical review of the considerations involved in the formation of alloys, particularly non-ferrous.

White Metal and Bronze Bearings from the Manufacturer's Point of View. M. Melhuish. Metal Industry (London), Vol. 48, page 209 (Feb. 14th, 1936).

A good bearing metal is produced by alloying a soft metal, such as tin or lead, with metals which form compounds and will separate out as small hard particles in the soft matrix. The tin-base alloys are most satisfactory, a typical analysis being 86 to 87% tin, 9 to 10% antimony, 3 to 4% copper. In this alloy two hard compounds are formed, one of tin and copper, one of tin and antimony. In order to produce these in the desired proportions the copper must be thoroughly alloyed with the tin before the antimony is added. Die-cast bearings are often used for light loads. For heavier loads, bronze-backed and, more recently, steel-backed bearings are employed. In the centrifugal casting process there is a tendency to throw the harder constituents toward the shell, retaining the softer matrix at the center; uniformity of quality in the bearing surface is thus difficult to maintain. For very heavy service, steel shells lined with 65 to 70% copper, 30 to 35% lead have come into use. Such bearings must be used with a hard shaft, otherwise the latter will wear. The heavy duty bearings of the future will probably contain about 75% copper, 21% lead, 4% tin.

Fused Magnesia in the Non-Ferrous Metal Industry. W. L. Patrick. Metal Industry (London), Vol. 48, page 231 (Feb. 21st, 1936)

Commercial magnesite of high purity, fused and crystallized, may contain as much as 98% MgO, melts at about 5100° F, is highly resistant to the chemical action of metals and fluxes, and is durable when exposed to sudden changes of temperature. It is particularly suitable for use in rotary or rocking furnaces, electric or fuel-fired, in the melting of brasses and higher melting-point non-ferrous alloys, and may be installed as performed, prefired shapes, or fired in place as a monolithic lining.

The Polishing of Metals. E. J. Dobbs. Metal Industry (London), Vol. 48, page 234 (Feb. 21st, 1936).

A lecture, followed by discussion, reviewing current practice in preparing castings for plating, or producing a permanent lustrous finish.

The Application of Metals in Chemical Engineering. H. W. Cremer. Metal Industry (London), Vol. 48, page 237 (Feb. 21st, 1936).

A discussion of the value of various metals and alloys with respect to their resistance to corrosion by chemicals at different concentrations and temperatures. Refrigeration temperatures and ultra-high vacuums are included.

The Possibilities of the Electric Furnace in the Brass Foundry. A. G. Robiette. Metal Industry (London), Vol. 48, page 271 (Feb. 28th, 1936).

A description of the Detroit rocking arc furnace. Speed of melting, economy and uniform control of casting quality are stated to be much in its favor It is particularly recommended for leaded alloys and for castings where freedom from porosity is of prime importance.

The Rationale of Phase Formation in Alloys. Anon. Metal Industry (London), Vol. 48, page 273 (Feb. 28th, 1936).

The second part of a theoretical article abstracted in the last issue

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Melts Scrap Metal in Brass Foundry. Anon. Foundry, Vol. 64, page 26 (March, 1936)

The plant and methods of the Keystone Brass Works, Erie, Pa., are described. The composition of 27 varied brass and bronze mixtures is given.

Modern Equipment

New and Useful Devices, Metals, Machinery and Supplies.

Wheel Dressing Machine

Divine Brothers Company, Utica, N. Y., have designed and are manufacturing a new wheel dressing machine for removing worn abrasive heads from polishing wheels and for truing wheels, to an accurate working face prior to the application of new abrasive heads. The machine is said to be rugged, eliminating chatter and vibration, giving accuracy of wheel truing for precision work and also for coarser work.

The machine is furnished standard in the rack and gear type. Transverse feed movement of the tool is manual by hand lever equipped gear segment and rack, actuating the tool-holding mechanism. This mechanism also has axial (crosswise) and radial (in and out) adjustments for the tool in relation to the wheel. Binding levers are provided for locking adjustments in all positions.

Divine Wheel Dressing Machine

Midget Plating Barrel

A small plating barrel, the "Midget" is announced by Chas. F. L'Hommedieu and Sons Company, 4521 Ogden Avenue, Chicago, Ill., for plating small work such as screws, tacks, washers, etc. The barrel uses a hard rubber bucket with no contacts on the inside. It can be operated for nickel, copper, brass, silver or cadium solutions. It is stated that all that is necessary is to take a bucket of solution out of a steel tank, pour it into the barrel and start plating directly.

The barrel is adjustable to any position. The bucket contains ribs which tumble the work while plating. To remove bucket, it is necessary only to slide the anode and cathode up and swing to the left. The anode is changed simply by unscrewing it from the copper rod.

Midget Plating Barrel

Soldering Flux

A new type of soldering flux called Solderux has been introduced by the Mann Instrument Corporation, Cambridge, Mass. It is said to have unique property of being highly active at soldering temperatures but inert and non-corrosive at lower temperatures, and to be non-hygroscopic.

The material is furnished in a pasty consistency, making it easier to keep in place when it is put on the work. It is said to contain no zinc or other chlorides.

Solderux is recommended for use with soft solders in any place where these solders are used: copper to copper, copper to brass, Constantan to brass, tinned iron to brass, etc.

Latest Products

Each month the new products or services announced by companies in the metal and finishing equipment, supply and allied lines will be given brief mention here. More extended notices may appear later on any or all of these. In the meantime, complete data can be obtained from the companies mentioned.

Self-Closing Vertical Lift Fire Door; operating speed under full control at all times; can be instantly reset after an emergency closing. Cornell Iron Works, Inc., 36-20 13th Street, Long Island City, N. Y.

Pneumatic-Type Controllers for Temperature, Pressure and Liquid Level. Model 90. Bristol Company, Bristol, Conn.

New Rods for Light Gauge Welding. "Thinweld," a specially coated electrode for arc welding light gauge sheet metal, is now offered in 1/16", 3/32" and ⅛" sizes by The Hobart Brothers Company, Troy, Ohio.

Portable Hydraulic Jack; 20-ton capacity for heavy duty work. Blackhawk Manufacturing Company, Milwaukee, Wis.

"Smootharc" Welding Electrodes. Coated rods for D.C. welding. Buchen Company, 400 W. Madison Street, Chicago, Ill.

Z-K Liftruck Systems; for transporting factory loads. The Z-K Equipment Company, 1227 Prospect Avenue, Cleveland, Ohio.

Sarco Water Blender. Automatically mixes hot and cold water brine and other fluids and delivers the mixture at any pre-determined constant temperature. Sarco Company, Inc., 183 Madison Avenue, New York.

Power Work Feed, Circle Cutting and Magnifying Glass Additions, furnished with Continental "Doall" machines for internal and external continuous sawing and filing. Continental Machines Specialties, Inc., 1301 Washington Avenue, S., Minneapolis, Minn.

"Silver **Anniversary" Micromax Recorder**; all combinations of indicating, recording, signalling and controlling. Leeds and Northrup Company, 4934 Stenton Avenue, Philadelphia, Pa.

Electric Marker. Portable electric tool for marking on practically any material. Ideal Commutator Dresser Company, Sycamore, Ill.

Alumaweld Flux. Used in conjunction with a special, high strength solder for aluminum, cast iron, etc.

Standard Independent Spindle Buffing and Polishing Machine

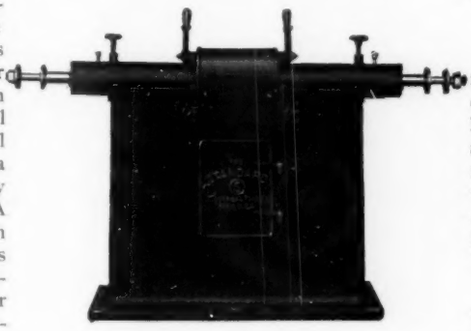
The Standard Electrical Tool Company, Eighth & Evans Sts., Cincinnati, Ohio, have added to their line of buffing and polishing machines an independent spindle arrangement illustrated below.

This machine has a 5 HP, 1800 RPM ball bearing motor mounted on an adjustable hinged bed plate inside the base. Each end of the motor shaft is fitted with a pulley transmitting power to a separate buffing spindle. Each spindle is made of high grade nickel steel and is mounted in heavy duty ball bearings. Each spindle is fitted with a tight and loose pulley, the loose pulley being equipped with ball bearings. A belt shifter is provided on each spindle assembly so that the belts may be shifted to the neutral position and either spindle stopped for wheel changes as desired, without interference with the other operator. A shaft locking device is included for use in changing wheels.

It is often necessary to have a change in spindle speeds and this arrangement permits the machine to be equipped with two different spindle speeds.

A hand adjusting screw at the back of the machine permits raising or lowering the motor to take care of belt tension.

The machine has a magnetic starter having overload and under-voltage protection mounted inside the base and connected with push button station at front of machine, convenient to the operator.



Independent Spindle Polisher

The entire arrangement is enclosed within the base and a large door on the back of the base permits convenient access to the motor, etc.

Automatic Pressure Compensator

In measuring the flows of compressible fluids such as steam, air and gas, variations in the static pressure of the flow directly influence the flow reading. To prevent errors from this source, The Foxboro Company, Foxboro, Mass., has developed the Automatic Pressure Compensator for Foxboro Flow Meters.

The Automatic Pressure Compensator mechanism is shown in the illustration. It is merely a simple spiral pressure tube connected to a lever.

As the line pressure changes, the spiral adjusts the multiplication of the linkage between the float and pen arm. This is not an additive correction but a percentage correction; the linear amount of correction differs at different points of the chart and is calibrated to fit the flow formula of the meter.

Thus a continuous, instantaneous and accurate compensation for pressure changes is obtained automatically. The Foxboro Automatic Pressure Compensator is sensitive to, and will correct, the position of the flow pen for a change in pressure as small as 1/10 of 1%.

At zero flow, pressure changes do not affect the position of the flow pen; at all other points on the chart the shift in pen position is just sufficient to compensate for the effect of this factor in the flow formula. On square-root flow scale meters the pen position is varied proportionately to the change in absolute pressure; on uniform flow scale meters, pen position is varied proportionately to the square root of change in absolute pressure.

Automatic Pressure Compensator

Should maximum flow and maximum pressure occur simultaneously, the pen will not travel beyond the upper chart limit.

If at any time a pressure-compensating meter is changed over to a service where compensation is not required, the meter is easily adapted to the new service. By attaching one screw on the Compensator to the mounting post in the instrument, the Compensator becomes inoperative and the differential calibration is that of a non-compensating meter.

The Automatic Pressure Compensator does not affect the inclusion of pens for recording pressure or temperature.

Heat Resisting Lacquer for Aluminum Ware

The coloring of aluminum ware by means of a coat of paint requires special characteristics on the part of the lacquer. A resin lacquer showing good adhesive qualities on all kinds of aluminum ware has recently been developed by the firm of J. W. Cleff, Dusseldorf: (Distributor for U. S. A.: F. Loewenberg, 10 East 40 Street, New York City.)

The lacquer has the appearance of enamel but is said to be ductile enough not to chip off but to adhere to the metal when the latter is bent or indented by impacts; and in addition, the heat resistance of the lacquer is high enough to be used on cooking utensils and the like.

The best surface condition for the application of the lacquer is the one in which the parts come out of the press. Buffing and polishing is apt to have an adverse effect upon the adhesive properties of the lacquer.

Spraying is done with ordinary equipment at a pressure of between 20 and 30 lbs./sq. in. Due to the high covering capacity of the paint, it is stated, one coat is sufficient to provide the surface with a lustrous finish. After spraying, the lacquer has to dry in air for about ¼ of an hour. Then, the parts are placed in an oven where they are allowed to bake for ¾ of an hour at a temperature of 350° F.

The lacquer comes in four standard colors: ivory, black, brown and red. Other colors can be furnished to order.

Rhodium Comparator

Baker and Company, Inc., 54 Austin Street, Newark, N. J., have developed a method for quickly determining the approximate rhodium content of a rhodium plating bath by means of the Baker Rhodium Comparator. The outfit is composed of a mahogany comparator housing, two graduated pyrex glass comparison tubes, fifty capsules of developing salt, one pipette, a test-tube holder, a bottle of Baker standard rhodium solution and a diluting dropper. The manufacturers state that the

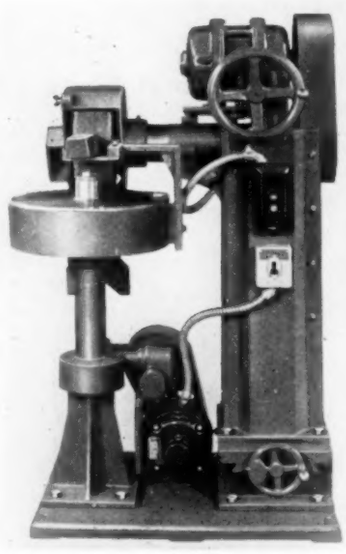
user can determine at any time how much rhodium he has in his plating bath at a cost of only a few cents for each test. Day to day tests can be made, accurate within plus or minus ten per cent.

The set (on which patents are pending) is inexpensively priced.

New Polishing and Buffing Machine

Acme Manufacturing Company, Detroit, Mich., has designed a new automatic polishing and buffing machine, Type "SM". This is a complete automatic for polishing and buffing screw heads, oval or flat, rivets, ends of pins, lock barrel facings and other cylindrical parts. The usual production is said to be from 2,000 to 5,000 pieces per hour. Speed adjustment is obtained through a three-step cone pulley drive. The work revolves as it passes across the face of the wheel for uniform finish and is then automatically ejected. Retainers are interchangeable and can be furnished for holding various sizes.

The machine is completely ball bearing equipped, with 1½ and ¼ H.P. totally enclosed motors, V-belt drive, guards, etc. It will handle a 5″ x 10″ wheel that can be used down to 5″ diameter. Net weight approximately 1,100 pounds, floor space overall 28″ x 38″.



Automatic Buffing Machine

Bearing Alloy

By H. M. DONEPP

Metallurgist, Jackson-Wheeler Metals Service, Inc., Brooklyn, N. Y.

The increased demand on bearings in the industrial field, by reason of heavier loads and higher speeds, has made necessary many improvements in quality and physical properties. An equally important factor from the standpoint of the user is to procure alloys which can be readily handled and poured by the accepted methods, and within the limits of ordinary shop practice, without special equipment or instructions.

The Jackson-Wheeler Metals Service, Inc., 320 Belmont Avenue, Brooklyn, N. Y., have followed this practice in bearing alloy technique. This is best illustrated perhaps by two alloys of their manufacture, namely "Tuftex" Super Service Metal (copper-treated) and "Tuftex" Lubrite Alloy (nickel-treated). These metals are not experimental or "new" in the sense of being in the laboratory stage—as both alloys have been on the market for several years, and have received the severest test of all, that of actual use and comparison under all conditions of service. Over a long period of time their success has been particularly noticeable in the heavier industries, such as paper mills, rolling mills, cement mills, etc.

By the proper use of Nickel and Copper, in correct proportions, and by methods that give permanence to the improved grain structure and bearing properties, the desired results are obtained. As already mentioned, these enhanced values, interpreted in terms of hardness, low co-efficient of friction, and resistance to pressure, must remain constant in the hands of the user—so that with the usual facilities at hand for melting and pouring babbitt metals, the original properties are maintained in the bearing.

In this connection, of particular interest is the action of Lubrite Alloy (nickel-treated) in every day application. The fine, "tool-steel" grain structure, which is characteristic of this bearing alloy, does not vary in the slightest degree in melting—even at a high degree of heat, which ordinarily would be harmful to babbitts not so alloyed. This eliminates one common danger in pouring bearings, and permits perfect ease in handling even under adverse conditions, or where the point of pouring the bearing is removed from the location of melting. A much higher melting heat is possible without any injury to the alloy, and at the same time perfect pouring qualities are present at the usual temperature.

Reasonable initial cost is a factor ever present in the calculations of those responsible for economical operation, and it would not be amiss to mention in this direction that the cost element is no higher than that of standard metals.

Photo-Chromometer

Hellige, Inc., 3702 Northern Blvd., Long Island City, N. Y., have developed a new photo-chromometer, a universal instrument for measuring color and expressing it numerically. It is recommended for the measurement of absorption, reflection and transmission on opaque solids, pulverized and semi-solid substances, transparent and translucent substances and liquids.

The instrument has been described as a radically simplified spectro-photometer. It is recommended for those who supply metals with color finishes and who desire to keep a record of the colors of different jobs for the purpose of duplicating them. A complete description is contained in bulletin No. 2000, which is obtainable on request.

Preventive for Nickel Pitting

Plating Products Co., 352 Mulberry St., Newark, announce an addition agent for nickel solutions, which will eliminate pitting difficulties. The time-honored method for correcting pitted nickel deposits has been the use of hydrogen peroxide. This material has to be added regularly and the amount consumed attains considerable proportions over a period of time.

The new type addition, called "Stop-Pit" solution is employed in the ratio of 1 gallon to 100 gallons of plating solution. One treatment is said to be enough for several months operation, as it is stated that the agent is not consumed or decomposed during the operation of the solution, the only loss being by drag out.

"Stop-Pit" solution, it is claimed, will not affect the character of the nickel deposit and ductility, whiteness and coloring up properties are not changed. Recent tests in commercial plants are said to have shown that "Stop-Pit" will remedy stubborn cases of pitting where the use of hydrogen peroxide has been only partially successful.

Acid-Alkalimeter

Palo-Myers, Inc., are now in a position to furnish their new Acid-Alkalimeter (made in two styles—large size and junior model), an instrument for automatic pH control, mounted in a cabinet 10″ x 16″ x 8″, with a relay unit and other necessary accessories, except for calomel cell, indicating electrode and battery. The advantages claimed for this instrument are:

Satisfactory with most any type of electrode.

Measures any pH from 0 to 14.

Direct readings without calculations.

Readings can be made by an unskilled operator.

No time lag in action of indicator.

Long distance control by wires.

No polarization at the poles.

Elimination of resistance effect in the cell and lead wires.

Will operate a relay for control purpose.

Can be used with glass electrode without the addition of any other expensive indicating equipment.

For complete information, write to Dept. M.I., Palo-Myers, Inc., 81 Reade St., New York.

Protective Coating for Zinc

Although zinc has, for many years, held the enviable reputation of being the most economical corrosion inhibiting metal known to industry. The New Jersey Zinc Company, 160 Front Street, New York, has just announced a new process to further the protective properties of this metal.

This new process produces a visible protective coating on zinc or cadmium, and zinc or cadmium coated metals, which materially reduces the corrosion rate and prevents the formation of white corrosion products under many conditions where they would otherwise form. Known as The New Jersey Zinc Company's Cronak Process, it has been patented by this Company, but its use is allowed through license agreement by them. The method of producing this film is by simple immersion in a very inexpensive solution after a thorough cleaning, and then drying. In appearance the film is not unlike brass with a greenish-brown iridescence, although this varies considerably with the length of time of immersion and the weight of the film which forms on the surface of the metal.

Fortunately, for industrial production practice, the color and its corresponding weight of coating is a direct indication of its protective value. That is, a brown coating which will be produced in an immersion of from 5 to 10 seconds will be definitely more protective than a light iridescent coating which could be produced on a zinc alloy die casting in from 1 to 5 seconds.

The solution recommended is one of sodium dichromate and sulphuric acid in water. Although this solution must be fairly carefully controlled, it has been very successfully used in the zinc alloy die casting production lines of several large industrial plants for over two years. It has also been given a successful industrial try out on zinc coated steel.

The largest applications made of the Cronak Process up to the present time have been on carburetors and automobile locks. Both of these parts have been made of zinc alloy die castings for a long time. Formerly a certain amount of sticking in the locks, where tolerances were very small, was undoubtedly due to the formation of white corrosion products by condensed moisture. Since the use of the Cronak Process has become general practice, however, in the production of these die cast locks, sticking trouble has been eliminated.

The clogging of carburetor jets was sometimes blamed on the corrosion products of zinc. These products had been observed in the carburetor bowls and although many other factors were present, these salts may have caused some of the trouble. Since the wide application of the Cronak Process to die cast carburetor production, however, this factor, it is claimed, has been virtually removed from the possible causes of this difficulty.

A survey by The New Jersey Zinc Company of the possible use of the film formed by the Cronak Process in improving the life of hot dip galvanized coatings has revealed some very interesting facts. In such investigations the corrosion is usually measured in the loss of weight of a specimen after exposure. In this particular test, after an outdoor exposure of two years, an untreated specimen had lost 40% more weight than one which had been subjected to the Cronak Process. Even this startling improvement does not give a completely correct story, for the weight of the corrosion products clinging to the untreated specimen, which were not present on the treated one, would throw a slight advantage to the untreated specimen. From this it is easy to see the value of this immersion treatment in slowing up the natural rate of corrosion.

New Catalogs

How to Use "Handy" Silver Solders, Sil-Fos and Easy-Flo Brazing Alloys. Bulletin No. 1. Contains results of laboratory and actual production data, including detailed instructions, and a number of practical hints on the subject of soldering and brazing with silver alloys; recommended procedure for the making of lap, butt and shear joints together with illustrations; also views of joints which have been proved unsatisfactory and should be avoided. Pictures and directions explaining and illustrating short cuts and savings in time, material, gas and air when joining ferrous and non-ferrous metals. A list of names, melting points, colors and uses of the 16 standard alloys made by Handy and Harman; also Sil-Fos, Easy-Flo and Handy Flux. Handy & Harman, 82 Fulton St., N. Y.

Facts About Stewart Industrial Furnaces. "A type and size for every need." Chicago Flexible Shaft Co., 5600 Roosevelt Rd., Chicago, Ill.

"Efficiency, Durability, Value" in the Udylite plating barrel. The Udylite Co., Detroit, Mich.

Tag Indicating Controllers; no motor; "controlling every instant." C. J. Tagliabue Mfg. Co., Park & Nostrand Aves., Brooklyn, N. Y.

Norblo Slow Speed, Low Power, Exhaust Fans; texrope driven. Northern Blower Co., 6409 Barberton Ave., Cleveland, Ohio.

Our Economic System, by Dr. Neil Carothers. American Iron and Steel Institute, N. Y.

The Constitution, by Hugh Morrow. American Iron and Steel Institute, N. Y.

Magnusol. Makes oils and greases quickly soluble in water. Suitable for motors and chassis, truck, bus and car bodies, etc. Magnus Chemical Co., 22 South Ave., Garwood, N. J.

Buyers' Guide to Warehouse Stocks of Nickel Alloy Steels. International Nickel Co., 67 Wall St., N. Y.

Norbide Molded Shapes (Norton boron carbide). Norton Co., Worcester, Mass.

Business Conditions and the Business Man, by Roy A. Foulke, Dun & Bradstreet, Inc., 290 Broadway. N. Y.

Blast Cleaning Equipment; quick-reference catalog. Pangborn Corporation, Hagerstown, Md.

"Protection While in Work"; paper "adhered" metals to protect the surface. American Nickeloid Co., Peru, Ill.

Rhodanize—Resistant of Tarnish. A booklet on rhodium plated work. Baker & Co., Inc., 54 Austin St., Newark, N. J.

Hydraulic Multi-Speed Lathe. Monarch Machine Tool Co., Sidney, Ohio.

Standard Chromium; non-sulphate chromium plating bath of improved efficiency and throwing power. Standard Chromium Corp., 521 Fifth Ave., N. Y.

Metallurgical Engineering, Chemical Engineering and Aeronautical Engineering. Rensselaer Polytechnic Institute, Troy, N. Y.

Hy-Speed Liquid Handling and Processing Equipment. Alsop Engineering Corporation, 39 W. 60th St., N. Y.

Plating Barrels; Mercil Type. Bulletin No. PB-105, describing and illustrating the latest designs in single cylinder, multiple cylinder, oblique and jeweler's plating barrels. Fully illustrated and containing considerable technical data. Hanson-Van Winkle-Munning Co., Matawan, N. J.

How to Make Plant Surveys with Graphic Instruments. Bulletin No. 436. Esterline-Angus Co., Indianapolis, Ind.

Industrial Dust Control Through Exhaust Systems, by W. C. Vedder. A well bound book describing the history of dust collecting systems to the present time and the many advantages of modern dust control. Free to requests on company letter-heads. Pangborn Corporation, Hagerstown, Md.

"Coordination." A brief description of the features of the Brown Air Operated Controllers. Brown Instrument Company, Philadelphia, Pa.

Metal Finishing. Vol. 1. No. 1. June, 1936. A new periodical discussing methods and materials used in finishing metals. R & H Chemicals Department, E. I. du Pont de Nemours & Co., Wilmington, Dela.

General Data Book. Ryerson Steel Service Section 5. Information on steels of all types. Joseph T. Ryerson & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.

Micromax Thermocouple Pyrometers. Catalog N-33A. Describing the complete line. Leeds and Northrup Co., 4900 Stenton Ave., Philadelphia, Pa.

Electric-Driven Two-Stage, Air-Cooled Portable Compressor. Bulletin No. 2198. Ingersoll-Rand Company, 11 Broadway, New York.

Roller Chain Sprockets Stock Book. Booklet No. 1557. Link-Belt Co., 307 N. Michigan Ave., Chicago, Ill.

Diesel Engines; vertical four-cycle, direct injection. Type BB. Worthington Pump and Mchy. Corp., Harrison, N. J.

Electric Melting Pots and Other Electrically Heated Industrial Equipment. Harold E. Trent Co., 618-640 N. 54th St., Philadelphia, Pa.

Metso 99—Sodium Sesquisilicate for Modern Industry's Cleaning Needs. Properties and uses in various cleaning operations.

Motorblower for Cupola Blowing. Bulletin No. 2145-A. Ingersoll-Rand Company, 11 Broadway, New York.

Associations and Societies

Boston Branch, A.E.S.

Care of Andrew W. Garrett, 100 King Street, Dorchester, Mass.

The first annual outing of the Boston Branch of the American Electro-Platers' Society will be held at Pemberton Beach, July 25, near Nantasket. The program will include sports, prizes and boating. A special program has been arranged for children who are cordially invited.

Cost of the dinner will be $2.00 for adults; $1.00 for children. The Boston Branch suggests that platers include this affair in their vacation program, right in the center of "New England Vacationland." For information write to Bert W. Sage, 42 Sagamore Street, Lynn, Mass.

The Electrochemical Society

Columbia University, New York

The 70th convention of the Electrochemical Society will be held at Niagara Falls, Ont., Canada, October 8-10 in the Hotel General Brock.

The session to be held on Friday morning, October 9, will be devoted to electrodeposition.

Aluminum Association

420 Lexington Ave., New York

The summer session of the Aluminum Association and its first meeting in the Middle West was held in Chicago during the week of June 15.

W. Y. C. Hunt, retired from the position of Eastern vice-president and **R. G. McKay** of the **Reynolds Metals Company,** 19 Rector St., New York, was elected to fill his post.

At a dinner held at the Drake Hotel, the principal technical address of the evening was delivered by **H. V. Churchill,** chief chemist of the research laboratories of the **Aluminum Company of America,** New Kensington, Pa., on the subject "Aluminum Keeps Its Face Clean," in which he described the problems of protecting the surface of aluminum and how they have been overcome. Other speakers were **W. E. Hotchkiss,** president of the **Armour Institute of Technology,** Pittsburgh, Pa., who spoke on the efforts of the universities to give engineering students an education which would better fit them for industry, and **A. V. Davis,** president of the Association and chairman of the Board of the **Aluminum Company of America,** who traced the growth of the aluminum industry during its life of 50 years.

Personals

W. J. R. Kennedy

William J. R. Kennedy was elected executive secretary of the American Electro-Platers' Society at the Cleveland convention in June.

Mr. Kennedy has been foreman in charge of plating at the East Springfield, Mass., plant of the Westinghouse Electric & Mfg. Co. eighteen years.

His connection with the A. E. S. started with the Providence convention

W. J. R. KENNEDY

in 1923. During that time he has held the offices of Vice President, and Editor of the Monthly Review. The latter office he has held without interruption since 1930.

The newly created office is a full time, salaried appointment and includes the duties of Secretary-Treasurer and Editor, as well as Treasurer of the Research Fund and all other duties assigned to him by the President and Executive Board.

Albert LeRoy Marsh

Albert LeRoy Marsh, president of the Hoskins Manufacturing Company, Detroit, Mich., was awarded, on May 20, the John Price Wetherill Medal by the Franklin Institute of Philadelphia, Pa., in consideration of the contribution of a material which has proved of extreme importance to the electrical industries. This material is the resistance metal manufactured by his company.

Mr. Marsh was born on August 6, 1877 in Pontiac, Ill. At an early age he evinced a strong interest in chemistry and physics. He graduated from the University of Illinois, having majored in chemistry, in 1901, and remained at Urbana for two years as assistant to the chemist of the State Water Survey. During the next few years, he worked as a writer of textbooks and in the storage battery manufacturing industry. He used his spare time, however, in researches in thermocouples. To carry on these researches more effectively he cooperated with William Hoskins, consulting engineer, who gave him the use of his laboratory under contract. In 1905 he discovered the combination of elements which was named "Chromel," on which he acquired a patent on February 6, 1906. The Hoskins Company was formed in August, 1908, in Chicago, and a few months later the headquarters were removed to Detroit, Mich. About a year later, Mr. Hoskins withdrew from the company which was reorganized as the Hoskins Manufacturing Company with Mr. Marsh as chief engineer. This company is now one of the outstanding producers of electrical resistance alloys of the United States.

Mr. Marsh, long ago, was responsible for the profit-sharing plan of extra compensation which has resulted in making the company an outstanding example of friendly employer-employee relations. They have had virtually no labor turnover. The company maintains no employment manager or personnel director.

Ross T. Phipps

A word of commendation is decidedly in order for **Ross T. Phipps,** manager of the exhibits at the recent convention of the American Electro-Platers' Society. A number of the exhibitors have expressed themselves to the effect that it was a most successful show. Mr. Phipps was "loaned" to the Society by the Bullard Company, Bridgeport, Conn., one of the exhibitors, in the interests of the electroplating industry.

ROSS T. PHIPPS

Mr. Phipps' business career includes seven years experience as buyer for automobile concerns in and around Detroit. He served two and a half years in United States Army Infantry and Air Service as Second Lieutenant. Leaving the service, joined The Bullard Company in October, 1921. He managed the Connecticut Purchasing Agents and Salesmen's first Industrial Exhibit in 1928 and those following in 1929 and 1935; the first A. E. S. Exhibit held in Bridgeport, Connecticut, in June, 1935; the first Massachusetts Purchasing Agents Exhibit held in Springfield, Massachusetts, March, 1936, and most recently the Second A. E. S. Exhibit held at the Hotel Carter, Cleveland, Ohio, June, 1936.

Emanuel Cohan, president of **Cohan-Epner Co. Inc.,** 122 Center Street, New York City announces the marriage of his daughter, Lillian, to Albert S. Goldblatt, son of Mr. & Mrs. Louis Goldblatt of 1321 Union Street, Brooklyn, N. Y. at Rothman's Inn, 285 Kingston Avenue, Brooklyn, N. Y., Sunday, June 28 1936. Reverend Sigmund J. Rome officiated. After a honeymoon in Bermuda Mr. & Mrs. Goldblatt will reside in Brooklyn. Miss Cohan is a graduate of Long Island University, Class of 1933, receiving a Bachelor of Arts Degree. Mr. Goldblatt received his Bachelor of Science Degree from the New York University and also took a post graduate course at the University of Iowa. He is at present associated with the Department of Public Welfare in the capacity of Social Worker.

Robert J. Wilson has been appointed general manager of the Western Metal Specialty Company, Milwaukee, Wisc., manufacturing freight car heaters, farm sanitation, motor truck stampings, etc. He was at one time president of the Kempsmith Mfg. Company, Milwaukee, manufacturer of milling machines and more recently executive vice-president of the Endestro Mfg. Company, Chicago.

Dr. Colin G. Fink, Columbia University, New York, received the honorary degree of Doctor of Science from Oberlin College. Dr. Fink was awarded the degree as "Master of Metals, Servant of Learning, of Industry and of Art; Benefactor through Brilliant Invention." At the coming XII Conference of the International Chemical Union in Switzerland, Dr. Fink will be the American guest speaker. His topic will be "The Electrochemical Protection of Iron and Steel Against Corrosion."

A. B. Parsons, secretary of the American Institute of Mining and Metallurgical Engineers, received the honorary degree of Doctor of Engineering from the South Dakota School of Mines, Rapid City, South Dakota, in recognition of his contributions as the editor, journalist and author to the literature of his industry and for his work for the advancement of the profession of engineering.

George M. Snodgrass has recently been appointed general sales manager of the Imperial Electric Company, Akron, Ohio, manufacturers of electric motors and generators.

R. E. Brown has been appointed District Manager of the San Francisco office of the Electro Metallurgical Sales Corporation, a unit of Union Carbide and Carbon Corporation, 205 E. 42nd St., New York. Mr. Brown joined the Electromet organization in 1920 soon after his graduation from Lehigh University, and for the past 11 years has been engaged in metallurgical work and in the sale of ferro-alloys on the Pacific Coast.

S. C. DuTot has been appointed as District Manager of the Chicago office of the Electro Metallurgical Sales Corporation, 205 E. 42nd St., New York. Mr. DuTot has been associated with the ferro-alloy business for more than 20 years. For the past 12 years he has been engaged in the sales activities of Electro Metallurgical Sales Corporation in New York and Chicago. Prior to 1924, he was employed as chemist at the Niagara Falls plant of Electro Metallurgical Company, another unit of Union Carbide and Carbon Corporation.

Harry Ingersoll has been appointed Pacific Coast representative of the Porcelain Enamel & Mfg. Co., Baltimore, Md., with headquarters at 4514 S. Van Ness Ave., Los Angeles. Mr. Ingersoll first entered the porcelain enamel field on the Pacific coast when he was connected with the plant of the California Metal Enameling Co., Los Angeles.

Wilfred S. McKeon (better known to the plating industry as **Liquid Sulphur** "Mac"), President of Sulphur Products Company, Inc. of Greensburg, Pa., sailed Wednesday, July 1, on the Gdynia America Line, S.S. Batory, for Europe. While in Europe Mr. McKeon will visit some of the leading cities in Russia, Germany, France, Denmark, England and the Irish Free State.

Charles B. Bohn, President of the Bohn Aluminum and Brass Corporation, has departed for a tour of Europe during which he will study engineering development abroad. Mr. Bohn is principally interested in the rapidly increasing use of aluminum alloys in the automotive as well as a number of other industries in England as well as on the continent.

F. S. Markert has been appointed assistant general manager of the Ferro Enamel Corporation, Cleveland, Ohio, manufacturer of porcelain enamels. Mr. Markert was graduated from the University of Illinois in 1924 and has been associated with the Ferro corporation since 1926.

Obituaries

Purcel O. Seiser

Purcel O. Seiser, superintendent of the Fairfield, Conn., plant of the U. S. Aluminum Company died on February 16. (See note in **Metal Industry,** May, 1936, p. 198).

Mr. Seiser was born in Bucyrus, Ohio,

P. O. SEISER

in 1891. He attended the Bucyrus Public School until he reached the age of 14. He obtained his first steady job with The Carroll Foundry & Machine Co. in Bucyrus. Working there for two years, he was offered a better oppor-

tunity with The American Malleable Iron Co. in Marion, Ohio. He stayed with this company less than a year, leaving to go to work for The Toledo & Ohio Central Railroad.

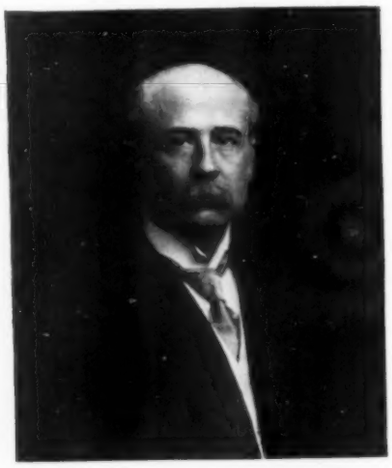
Mr. Seiser decided he was cut out to be a foundryman and in 1908, after being a railroader for less than a year, he went with The Ohio Steel Casting Co. in Lima, Ohio. After being here for two years, Mr. Seiser moved to Pittsburgh, Pa., to work for The Lawrence Steel Casting Co. He stayed with this company until 1914, leaving to go with The Essex Indicator Co. in Pittsburgh. He was with this company only a short time when he was offered the position of Superintendent with The Standard Steel Car Co. in Verona, Pa.

In 1918, Mr. Seiser came with the Aluminum Company of America in Cleveland, Ohio. In 1920, he was transferred to The United States Aluminum Co. in Fairfield, Conn. Mr. Seiser remained in the Fairfield Plant as Foundry Superintendent for sixteen years, until his death on February 16, 1936.

He was a true example of a self-made man and an all-around good fellow. He is missed.

Dr. Lucius Pitkin

Dr. Lucius Pitkin, internationally known chemist and metallurgist died on Sunday, June 14 in New York of



DR. LUCIUS PITKIN

coronary thrombosis. He was 76 years old.

Doctor Pitkin came very close to being a real Yankee, his birth in New York breaking a line of New England dwellers dating from 1641—his mother, Ellen F. (Wood) and his father, Lucius Pitkin, being Vermonters.

His education was in the public schools and the College of the City of New York, from which he received his A.B. degree in 1878. Entering the School of Mines of Columbia University in 1878, Doctor Pitkin began his real chemical education under Charles F. Chandler, obtaining his Ph.B. degree in 1881 and subsequently taking his Ph.D. degree from the same institution.

While still a student in the School of Mines, a couple of papers on the action of sulfuric acid on lead and its alloys, which he wrote and read before the American Chemical Society, attracted the attention of William H. Nichols, then treasurer of the Society, and in 1881 he became chemist to the Laurel Hill Chemical Works, of which Doctor Nichols and his father were proprietors. This connection probably determined largely the character of the work of the Pitkin laboratory, which was established in 1885, since the Nichols interests became large factors in the field of copper refining, the pleasant relations established in 1881 continuing to the present day. The laboratory has been largely a metallurgical one, and copper and the various products connected with its electrometallurgy an important but by no means a sole concern.

Doctor Pitkin, a true gentleman of the old school, was admired and respected by those who knew him, not only for his genial character, but for his wide knowledge and happy faculty of being able to explain matters scientific and seemingly mysterious so that they became easily understandable to the layman. Those who were in close personal contact with him realized that his interest was always in their welfare.

Samuel Goldfarb

Samuel Goldfarb, 30 of 302 Eastern Parkway, Brooklyn, N. Y., was killed recently by two young gunmen when he unwittingly walked into the manufacturing jewelry firm of his father, 338 Canal Street, New York, while they were looting it. Young Goldfarb, who was an officer of the firm known as Goldfarb and Friedberg, arrived while his father, Benjamin and an employee, Louis Silverman, were lying bound and gagged in a back room, according to police. The bandits escaped with an undetermined amount of jewelry.

Mr. Goldfarb was born in New York but lived in Brooklyn about 25 years and attended school there. Surviving, besides his father, are his mother, two brothers, Louis and Bernard and five sisters, Mrs. Celia Weltz, Mrs. Beatrice Freedman, Mrs. Sadye B. Freedman, Rhea and Hannah.

Frank R. Sweet

Frank R. Sweet, Mayor of Attleboro, Mass., died May 27 at the Baker Memorial Hospital. He was stricken with a heart attack.

Mayor Sweet was born in Somerset, October 3, 1880, descending from old Yankee stock. His father, William O. Sweet, later moved to a farm in West Mansfield. As a boy he learned the jewelry business and later started business himself as a chain manufacturer, the Sweet Manufacturing Company. He was the owner of Glenwood Farm and specialized in fine breeds of poultry, cattle and dogs. He was also interested in hunting and was the founder of the New England Field Trial Club and was its president for five years.

He is survived by a wife, and a son; three children by his first wife; two brothers.

Ferdinand W. Roebling, Jr.

Ferdinand W. Roebling, Jr., 57, president of John A. Roebling's Sons Co., Trenton, N. J., died May 29 in Harkness Pavilion at New York Medical Center, of complications. He lived at 222 West State Street, Trenton. Mr. Roebling was the son of Ferdinand W. Roebling and was graduated from Lehigh University as a mechanical engineer in 1901. He is survived by his wife, Ruth Metcalf Roebling, and two sons, Ferdinand, 3d, and Joseph M. He began engineering with the firm of his ancestors, John A. Roebling's Sons Co., wire manufacturers.—**C. A. L.**

George Cooling

George Cooling, 75, founder and president of the Ace Foundry and Engineering Co., Jersey City, N. J., died recently at Irvington, N. J. Mr. Cooling was born in England and had been affiliated with the foundry industry almost 50 years. Prior to his formation of the Ace Foundry & Engineering Co., four years ago, Mr. Cooling had been foundry foreman of the Eureka Fire Hose Co., for 23 years.

Ralph Bartlett Goddard

Ralph Bartlett Goddard, 75, sculptor who devoted many years of his career to the execution of bronze basrelief portraits of noted men and to other art work, died recently in Middletown, N. Y. In his later years, Mr. Goddard made a specialty of portrait busts and was the creator of several bronze heroic statues, including a statue of Gutenberg which he created for Robert Hoe, printing press maker of New York.

Thomas Newell

Thomas Newell, long active in the development of the brass industry in Connecticut, died recently in the Mt. Vernon, N. Y. Hospital of a heart ailment after an illness of a week. He was 82 years old.

Mr. Newell started in the brass industry more than sixty years ago in Westport, Conn., his birthplace. In 1900 he joined the American Tin Company, Waterbury, and rose to position of superintendent. In 1915 he became general manager of the Bartlett Haywood Company of Baltimore, munitions manufacturers. He retired in 1922 and moved to 254 Grand Street, Mt. Vernon, where he lived with his wife, Mrs. Margaret O'Brien Newell and daughter, Miss Margaret Newell who survive.

George H. Feltes

George H. Feltes, 57, president and treasurer of the Standard Electrical Tool Co., Cincinnati, Ohio, died May 6

at French Lick Springs, Ind. Mr. Feltes was born in Glendale, Ohio. He became an international figure and was a pioneer in the electrical tool industry. He entered the field in 1903 at which time he financed the organization of the United States Electrical Tool Co., acting as secretary, treasurer and sales manager from 1903 to 1925 when he retired from business. He re-entered active business in 1926 after acquiring control of the Standard Electrical Tool Co.

Frank J. Dunn

Frank J. Dunn, of the manufacturing jewelry concern of Dunn Brothers, 139 Baker street, Providence, died June 16 at the Jane Brown Hospital, wnere he underwent an operation the previous day. He was 49 years old, having been born June 13, 1887 at North Attleboro, Mass. He was a son of Matthew J. Dunn of the manufacturing jewelry concern of Dunn & Rodenburg. In 1919 he formed a partnership with his brother Matthew T. Dunn and as Dunn Brothers has since conducted the business. He is survived by his widow, one son, two daughters, his mother and brother.

—W. H. M.

Charles J. Barnes

Charles J. Barnes, superintendent for 17 years of the Falcon Bronze Co., Youngstown, Ohio, died May 11 in Youngstown. Mr. Barnes was formerly employed by the United Engineering and Foundry Co., before going to the Falcon Bronze Co., and more recently was with Republic Steel Corp. He had resided in Youngstown most of his life.

Earl V. Hennecke

Earl V. Hennecke, 52, president and an organizer of Automotive Equipment Company, Long Island City, N. Y., died May 11th. A former director of the Motor & Equipment Manufacturers Association, he had been vice-president of Moto Meter Company and a member of former President Hoover's committee on industrial standardization.

William B. Anderson

William B. Anderson, president, Buckeye Iron and Brass Works, Dayton, Ohio, died on May 27, aged 80 years. He had been identified with the company for 60 years. He started his career with the company as a bookkeeper, later becoming secretary, and had been president since 1917.

John N. Derschug

John N. Derschug, president of the Easy Washing Machine Corp., Syracuse, N. Y., died in that city on June 2nd.

William H. Landers

William H. Landers, 78, president of W H. Landers Co., Inc., Syracuse, N. Y., stove, heating system and heat-treating equipment manufacturer, died June 5th.

Henry C. Cashden

Henry C. Cashden, 72, who retired in 1934 as master mechanic of Bradley and Hubbard Co., Meriden, Conn., brass goods manufacturer, died May 19.

Abel Kenworthy

Abel Kenworthy of Waterbury, Conn., organizer and builder of the Waterbury Rolling Mills and an inventor, died recently. Mr. Kenworthy was 89 years old.

Metal Developments

Statistics on sales of **white-base antifriction bearing metals** have been released by the Bureau of the Census, Department of Commerce, Washington, D. C. Based on data from 39 manufacturers, total production amounted to 2,413,979 pounds in April, 1936, against 2,064,475 pounds in March, 1936, 1,829,602 pounds in April, 1935, and 2,024,211 pounds in April, 1934.

A radio broadcast was delivered by **Professor Robert S. Williams** of the Massachusetts Institute of Technology during the week of June 9 for the Northeastern Section of the American Chemical Society. He discussed the field of non-ferrous alloys, emphasizing particularly the comparatively recent important developments, such as Duralumin, magnesium alloys, beryllium, beryllium bronze, lead-calcium-sodium, etc.

The **Berger Mfg. Company** of Canton, Ohio, one of the largest sheet metal products manufacturing organizations in the United States is celebrating its 50th year in business.

Three new low-priced **Alzak** aluminum floodlights covering the range of wattages from 300 to 1,500, have been announced by **General Electric Company.** The floodlights are made of aluminum treated by the Alzak process, which it is stated, has a permanent high efficiency.

R. J. Roshirt, manager of the **Permanent Mold Division** of the **Bohn Aluminum and Brass Corporation,** Detroit, Mich., reports a tremendous growth in the use of permanent mold aluminum castings. Among the industries which have found them satisfactory are vacuum cleaners, washing machines, bicycles, various household implements, automatic vending machines, radiators for heating, typewriters, shoe repairing machines, aircraft parts, powder can parts, etc.

With Summer here, and with it, mosquitoes, flies and other insects, the **Copper and Brass Research Association** aptly recommends the use of bronze screens which do not rust, as the best possible protection.

Are you making a trip to New York this summer? If so, you will be interested in the June-July issue of the **"Oasis"** published by the **Egyptian Lacquer Manufacturing Company, Inc.,** Rockefeller Center, New York City, which describes Rockefeller Center, its points of interest and the special attractions for visitors. Copies free on application to the Egyptian company.

A process for coating steel work in place is announcement by **Duraspray, Ltd.,** London, England, consisting of applying a priming coat of a special type of red lead paint, then dry-spraying on the wet surface of the priming coat a very finely divided metallic powder, consisting of zinc dust with a certain proportion of aluminum, and then finally applying a finishing coat of paint of the required character and color.

The **American Bureau of Metal Statistics** recently published an annual survey on the use of copper, aluminum, lead for transmission, distribution, etc., by electric power. The Bureau estimates that exclusive of TVA lines and similar operations, the utilities used about 4,281 tons of aluminum in 1935 against 1,434 tons in 1934 and 1,600 tons in 1933. They used 14,081 tons of lead in 1935 against 18,193 tons in 1934. Public utilities which accounted for about 56 per cent of the total output of electricity, consumed 34,295 tons of copper in 1935 against 26,830 tons in 1934. The general conclusion is clear, that there was a large increase in 1935 in the use of copper and other metals for conductors.

New Research Associate Plan at Battelle

The Trustees of Battelle Memorial Institute have announced a new plan to extend the scope and utility of the educational features of the Institute's basic program of scientific research. Since its inception, the policy of Battelle Memorial Institute has been to combine a program of fundamental research of general interest to industry with the applied research which it has carried on for individual companies and associations under its plan of sponsored research.

A new Division of Research Associates has been established to supplement the work in fundamental science of the regular technical staff. The purpose of this new Division is to offer intensive training in practical research to the best of the younger workers in selected branches

of chemistry, metallurgy, fuels and ceramics. Appointments as Research Associate will be made for one year's duration and may be extended for a second year. A Research Associate will be expected to devote his entire time to a research problem approved by the Director and supervised by members of the Institute staff. The results of these researches will be published in order to contribute information that will be useful.

Appointments as Research Associate are open to graduates of any accredited university or college, but preference will be shown to men who have demonstrated a marked aptitude for scientific research in their industrial experience or through one or more year's graduate study. The appointment will carry an annual salary of from $1,200 to $1,800 depending on the training and experience of the individual. Four appointments as Battelle Research Associate will be made for the year 1936-1937.

Applications for appointment as Battelle Research Associate may be obtained from the Director, Battelle Memorial Institute, Columbus, Ohio.

Bridgeport Brass Company Exhibit

The most popular man at the **Bridgeport Centennial Exposition** was the eight foot Cowboy made of brass, bronze and copper standing in the booth of the **Bridgeport Brass Company.** He was designed by the artist, **Lowell L. Balcom** of Silvermine, Conn., and was made by the tinsmiths of the Bridgeport Brass Company, Bridgeport, Conn.

In its forty-six feet of exhibition space, the Bridgeport Brass Company showed to advantage the many products which it manufactures. Against a background of blue, illuminated by concealed lighting, were exhibited brass and copper mill products. On bright orange panels were displayed the famous Ledrite rod for automatic screw machine work, condenser tubes and plates, brass, bronze and copper sheets and rolls, brass and bronze wire, copper water tubing, plumbers' brass goods, fabricated items, welding rod, Duronze high strength alloys used for making bolts, nuts, wire clamps and clips used for catenary construction and pole-line hardware.

One of the most interesting exhibits showed the cut-away section of a house piped with copper tubing and solder type fittings. Copper tubing with soldered fittings is a comparatively new development which is being used for underground service lines, hot and cold water piping, for fuel oil from the tank to the oil burner and for steam and hot water heating lines. Because the copper tubing is supplied with a wall thickness which is approximately half that of pipe, and owing to the cleverness of the solder type fittings and the ease of installation, it is possible to install copper for practically the same price as rustable piping. Smaller sizes of copper are used than iron because of the low internal friction and the fact that no allowance has to be made up on account of rust clogging the piping.

For heating lines, small diameter copper tubing makes possible less loss due to radiation. Usually, copper heating lines are shined up with steel wool and are lacquered but not covered with insulation. Since the copper comes in coils as well as in hard straight lengths, it is possible to effect great economies especially when old houses are modernized.

The Duronze Alloys exhibit calls attention to the remarkable development of non-ferrous alloys which took place during the lean years of the depression. Duronze I bolts, for example, which are used for high tension electrical construction, water meters and electric refrigerators have the high tensile strength of approximately 100,000 lbs. per sq. in. Ordinary steel bolts used for automobile construction have a tensile strength of only 65,000 or 70,000 lbs. per sq. in. This particular Duronze Alloy consists of aproximately 97% copper and 3% of alloying elements. In sheet form, Duronze II is manufactured into automatic heaters and storage tanks by the oxy-acetylene or electric arc welding processes. A large quantity of Duronze II alloys were used at Boulder Dam for the construction of cable clamps in connection with the electrical equipment.

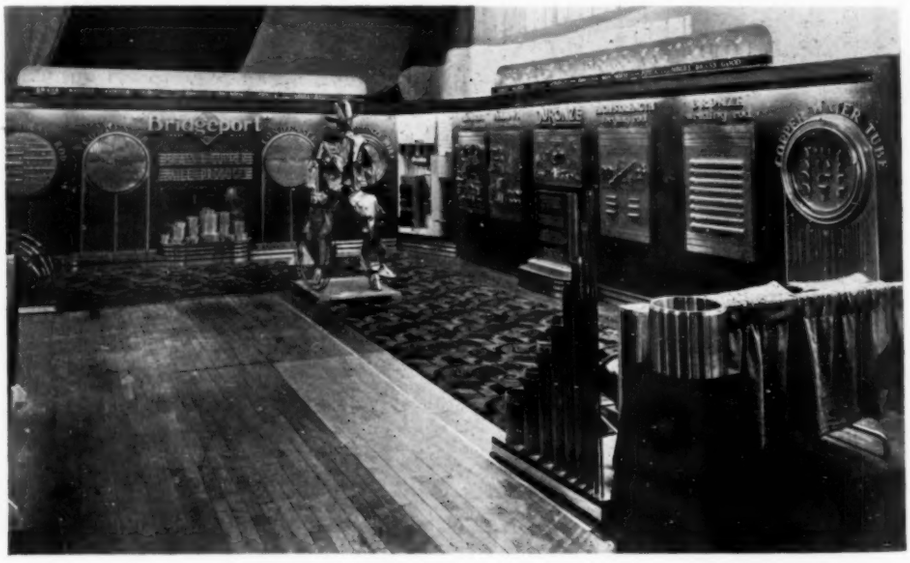


Exhibit of the Bridgeport Brass Company at the Bridgeport Centennial Exposition

Business Items-Verified

Southern Equipment Company, St. Louis, Mo., has let general contract for a one-story addition, 40 x 150 feet to cost over $50,000 with equipment. The company manufactures metal lunch room equipment, containers, etc.

Wolverine Brass Works, 620 Monroe Avenue, N. W., Grand Rapids, Mich., are having roof of their foundry raised to provide better ventilation and light and improve working conditions.

Keystone Chromium Company, Niagara Street, Buffalo, N. Y., have put into effect wage increases ranging from 10 to 15 per cent, for the entire working force, according to **J. Lawrence Osborne,** treasurer. Production is now running 30% in excess of that of 1935, it is stated. Two new departments, an electro-tinning and an electro-galvanizing, have been added to company operations this year. The electro-galvanizing tanks are 24 ft. long.

M. Greitzer Mfg. Company are moving to a larger building at 739-41 Merchant Street, Los Angeles, Calif. The company manufactures modern chrome metal furniture. The following departments are operated: stamping, brazing, plating, polishing, grinding room and lacquering.

Milwaukee Metal Spinning Company have put up a new plant at 1323 S. 43rd Street, Milwaukee, Wisc., which it will

occupy in the near future, moving from 227 E. Lincoln Avenue. The new factory will provide about 5,000 sq. ft. of floor space. More machinery is being added and the total layout will amount to approximately $25,000. Officials of the firm report that last year was the best in the concern's history. It was founded 17 years ago. The following departments are operated: spinning, soldering, brazing and welding, polishing and lacquering.

U. S. Stoneware Company have changed their address from 50 Church Street to 60 E. 42nd Street, New York.

Chase Brass and Copper Company, Waterbury, Conn., have opened a new branch warehouse at 301 W. Exchange Street, Providence, R. I. They plan to carry large stocks of brass and copper products in this warehouse for quick delivery. **F. M. Burton** has been appointed branch manager. The Chase company now has 18 warehouses throughout the United States, with plants in Waterbury, Conn., and Cleveland, Ohio.

Chemical Service Corporation, 101 E. 19th Street, New York, began their 16th year of purchasing surplus finished and raw materials as well as developing markets for industrial wastes, residues and sludges of all kinds.

The **Metallizing Company of America, Inc.,** Los Angeles, Calif., announce the opening of a new branch office located at 407 Call Building, San Francisco, Calif. The office will be in charge of **E. T. Parkinson.**

Art Metal Works, 3795 14th Street, Detroit, Mich., have leased building at 6188-90 12th Street for new plant, expanding present capacity. This firm operates the following departments: brass machine shop, spinning, stamping, soldering, brazing, plating, polishing and grinding room.

Seeger Brass Company have been chartered at Toledo, Ohio, with a capital of 200 shares no par common stock to establish plant to sell brass and copper rod, sheet and tubing, etc. The new location is 21 St. Clair Street. **Valentine Seeger,** head of the new company, also heads the **Toledo Brass and Iron Works.** The latter is a brass foundry and machine shop which has been operated by the Seeger family for 51 years.

Zenith Radio Corporation, 2630 S. Iron Street, Chicago, Ill., plan construction of a plant costing over $40,000. This firm operates the following departments: tool room, stamping.

Samuel Greenfeld Company, 174 Gilbert Avenue, Buffalo, N. Y., scrap metals, have acquired former plant of Kellogg Structural Steel Company, Bailey Avenue, and will remodel for non-ferrous metal smelting plant with installation of furnaces, mechanical-handling and other equipment. One story addition will be erected. Cost over $80,000 with machinery. This firm operates a smelting and refining department.

Hoosier Lamp and Stamping Company, Evansville, Ind., manufacturers of stamped metal goods, have acquired property at Edgar and Eichel Avenues, 100 x 255 ft., for new one-story plant, superstructure to begin soon. Cost close to $50,000 with equipment. This firm operates the following departments: tool room, stamping, plating and polishing.

Ballonoff Metal Products Company, 6407 Woodland Avenue, S. E., Cleveland, Ohio, manufacturers of sheet metal products, conduits, etc., have leased two-story building at 5815 Kinsman Rd., S. E., about 20,000 sq. ft. floor space, for new plant with increased capacity. The firm operates the following departments: cutting-up shop, stamping.

American Foundry Equipment Company, 408 Byrkit Street, Mishawaka, Ind., announce the appointment of the following territorial sales engineers: **G. H. Walsh,** Graystone Hotel, Buffalo, N. Y.; **H. G. Mouat,** Martin Building, Birmingham, Ala.; **F. R. Smith,** Box 497, New Orleans, La.; **T. C. Ruhling and Company,** Burt Bldg., Dallas, Tex.; **H. B. Heisner,** 303 Sugar Bldg., Denver, Colo.

Tillman Electroplating Works, Inc., have moved from 197 Grand Street to 636 11th Avenue, New York. The facilities have been greatly increased, modern equipment has been added, larger units installed and the plant has been laid out with a view to eliminating waste motions in every detail. Shipping and receiving facilities are of the best, as it is possible to bring trucks directly into the plant when necessary. The company has been operating continuously since its establishment in 1860.

The **Campbell-Hausfeld Co.** of Harrison, Ohio, manufacturers of gas and oil fired melting furnaces, announce the appointment of Gerald B. Duff, 39 Oxford Street, Newark, N. J., as their sales representative in Metropolitan New York.

The **Grand Rapids Brass Company,** of Grand Rapids, Mich., have adopted a comprehensive group insurance program which provides their employees with approximately $250,000 life insurance and about $250,000 accidental death and dismemberment coverage, supplemented by weekly sickness and accident benefits. Announcement was made by **R. W. Geyer,** president of the company. The group plan is being underwritten by the Metropolitan Life Insurance Company on a cooperative basis, whereby the employer and employees share the cost.

The **Greenfield Tap and Die Corporation** of Greenfield, Mass., announce the acquisition of the plant facilities, experience and good-will of the **J. M. Carpenter Tap and Die Company** of 2102 West Fort Street, Detroit. This plant will be operated as a branch of the Greenfield concern. The new plant will be under the management of **Alfred LaPierre** who, for a number of years, has been superintendent of the **Gauge Department** at "Greenfield's" main plant in Greenfield, Mass. He will be assisted by the following: **Versil Annis,** who will be Office and Merchandise Manager; **Glenn Stimson,** who will have charge of engineering, and **Roy Peterson,** Metallurgist, in addition to the Carpenter office and factory employees who will be absorbed by Greenfield. **Al. Kiehne** will continue as Chief Inspector.

The **Hanson-Van Winkle-Munning Company** of Matawan, N. J., has been designated sole representative in the United States for exploitation of the new patented Bright Cobalt Nickel Process recently developed by **Weisberg & Greenwald, Inc.** of New York City. A distinguishing feature of this bright nickel solution is the fact that the deposit contains some cobalt. In operation this is supplied from anodes for which reason special cobalt nickel anodes are used. A complete description was published in **Metal Industry** for January, 1936, page 27.

John Penny, who has been in charge of sales for the Greenfield Tap and Die Corporation, Greenfield, Mass., in the Detroit area, will be District Sales Manager. Greenfield's present Detroit sales force, which consists of three men, will be augmented by the two former Carpenter salesmen, Messrs. **Richmond** and **Willis.** General Manager **F. A. Smith** announces that in line with the fast pace set by the automotive industry, the plant will be completely modernized and equipped to furnish special taps on a delivery schedule of one to two days after receipt of orders.

The **Vulcan Detinning Co.,** of Sewaren, N. J., has adopted a double coverage group insurance program in which more than 120 employees of the company have enrolled. It includes nearly $140,000 life insurance, in addition to sickness and accident benefits. The insurance is being underwritten by the Metropolitan Life Insurance Company on a cooperative basis whereby the employer and employees share the cost.

The **Lea Manufacturing Company** of Waterbury has added a complete line of sawdust to its already extensive line of platers' supplies. It is carrying hardwood, kiln dried sawdust ranging from the finest to the coarsest.

General Refractories Company, Philadelphia, Pa. have removed their general offices into new quarters in the Real Estate Trust Building at Broad and Markets Streets, that city.

Chain Belt Company announces that its Pittsburgh office has been moved to Room 526—Grant Building, Pittsburgh, Pa. Along with this move, G. E. Mahoney, formerly a sales engineer in the Milwaukee offices of the Chain Belt Company, will be located in the Pittsburgh Office.

Balbach Smelting and Refining Company announces the removal of its offices to twelfth floor, 63 Park Row, New York.

News From Metal Industry Correspondents

New England States

Waterbury, Connecticut

June 26, 1936.

Employment in the city was 33 less in May than in April but 2,845 greater than in May, 1935. The number employed in all plants was 31,902 and the number employed in the eight largest was 16,996, a decrease of 142 as compared with April and an increase of 1,712 as compared with May, 1935.

John H. Goss, vice president of the **Scovill Mfg. Co.,** and **Clifford F. Hollister,** vice president of the **American Brass Co.** were reelected last month as directors of the **Connecticut Chamber of Commerce** for two year terms.

R. W. O'Neil, manager of the **Shoe Hardware Co.** states that the increase just made in the import duty on foreign made slide fasteners, has barely saved this industry from ruin. A year ago the company was operating three shifts a day but foreign competition caused employment to be reduced one-half. Most of the competition comes from Italy, Germany and Czechoslovakia.

Richard W. Van Riper, president of **Industrial Properties, Inc.** has written the **Remington Rand Co.** inviting it to move its Middletown plant here. It has indicated it might move because of a strike. The local concern owns a number of closed factories.

The **Lux Clock Co.** plans shortly to erect two four-story brick buildings with total floor space of 45,000 square feet. Both will be devoted to manufacturing and will mean the employment of about 250 more workers. It now has 700. The cost of the addition will be $150,000.

A soap bubble pipe, invented by **George A. Mausoff,** an employee of the **Waterbury Button Co.** is one of the best chain store sellers, **W. F. Reibold,** sales manager of the company, announces. Over 4 million of them have been made by the local company.

Waterbury individual income tax returns filed in 1935 for the previous year were 832 more than filed the preceding year, or a total of 5,320.—**W. R. B.**

Connecticut Notes

June 26, 1936.

NEW BRITAIN—Representatives of the **National Labor Relations** board held a hearing here last month on the complaint of workers of the **Stanley Works** that the company had refused to deal with the Machinists Union. Officers of the company denied that they had refused to deal with the union but said they refused to sign a proposed agreement which calls for extravagant and unreasonable concessions.

An independent union is being formed by the employees of **Landers, Frary & Clark,** designed to take in all departments of the company. It has already proposed an increased wage scale for all workers and for improved sanitary and other working conditions.

BRIDGEPORT — The **American Chain Co.'s** business for the first quarter was 40 per cent ahead of last year, according to its **President, Walter B. Lashar.** The stockholders reelected the old officers and directors last month.

HARTFORD—The **Hamilton Standard Propellers** division of **Pratt & Whitney Aircraft Co.** has started construction of a new building costing $250,000 which will be used for manufacturing.

MIDDLETOWN—Attempts to settle the strike of the 1,500 employees of the local **Remington-Rand** plant have failed and the company is threatening to leave the city. The Mayor, on the request of the company, has agreed to try to sell the company's property here.

BRISTOL—The **E. Ingraham Co.** and the **Sessions Clock Co.** will not shut down this summer for two weeks for inventory as usual, because of increased business. The **Bristol Brass Co.** will close for one week as customary. The **Veeder-Root Co.** and the **Wallace Barnes Co.** will continue their staggered vacation plan but will not close down.

Frederick G. Hughes, vice president of the **New Departure Co.,** has been reelected a director of the **Connecticut Chamber of Commerce.**

NEW HAVEN—The **New Haven Chamber of Commerce** has invited the **Remington-Rand Co.** to move its Middletown plant to this city.

—**W. R. B.**

Providence, R. I.

June 26, 1936.

The industrial situation in Rhode Island, looked at from almost any angle, shows an improvement that is giving the commercial interests, both employer and employee, the most substantial grounds for optimism that has been experienced in a long time. And the metal trades are no exception. Payrolls of non-ferrous metal firms in the State last month reached a new six-year high for the month of May. Working forces throughout the State showed an increase of nearly seventeen per cent over the corresponding month of last year and an advance of nearly two per cent over the preceding month this year. Jewelry and silverware manufacturers increased 4.8 per cent in employment over the preceding month, and 1.5 per cent over a year ago.

According to figures compiled by the **Brown Bureau of Business Research,** workers in the non-ferrous industries received $197,855 in wages during May, a gain of 56.8 per cent over the same month in 1935.

An industrial Exposition designed to show the evolution of the State's industrial productions for a century or more will be held in the State Armory at Cranston and Dexter streets, Providence, in September if the present plans of the **Tercentenary Committee** are consummated. Among the organizations that have indorsed the enterprise are the **New England Manufacturing Jewelers' and Silversmiths' Association** and the **Associated Industries of Rhode Island.**

Arrangements for this **Tercentenary Industrial Exposition** will be in charge of **G. A. Parsons,** who has a wide experience in such matters, and who arranged the recent successful Connecticut Industrial Exhibition at Hartford. Exposition headquarters have been established at the Providence Chamber of Commerce building in Market Square.

The **Albert Manufacturing Company** of 85 Sprague street, Providence, manufacturers of jewelry and costume novelties, have formed a Canadian subsidiary under the name of the **Albert Manufacturing Company of Canada, Ltd.,** of which **F. W. Sawtelle,** of Toronto, where the new factory will be located, is vice-president and general manager. The Canadian plant will specialize in the manufacture of costume jewelry.

A one-story concrete addition, 24 x 33 feet, is being erected at the manufacturing jewelry plant of **George F. Berkander,** 891 Broad Street.—**W. H. M.**

Middle Atlantic States

Utica, N. Y.

June 26, 1936.

Satisfied with a spring business that was better than usual this year metal manufacturers in the Mohawk Valley are now going through the usual slack summer period.

The **Bossert Corporation,** Utica, N.Y., is working along steadily on extensive automobile and housing orders.

Savage Arms Corporation, Utica, enjoyed a brisk spring business in sporting goods.

A completely new principle of sheet buffing has been developed by **Divine Brothers Company,** Utica, N. Y., in a machine recently installed. Sheets are held in a revolving drum and brought into contact with a buffing wheel. Cut-down and color buffing and satin finishing are said to be advantageously handled.

F. F. Despard, Utica dealer for the **Norton Company,** Worcester, Mass., addressed Rotary Club here giving them the history of abrasives.

Bradford Hoyt, vice-president of the **Ilion Typewriter Employees Association,** said that the **Federation** of Labor unions have disappeared from the **Ilion Remington Rand** plants. The strike is over, plant officials say.—**E. K. B.**

Newark, N. J.

June 26, 1936.

The **Ingersoll-Rand Co.**, has leased the property at 899 Frelinghuysen Avenue for a term of years as its main distributing center for northern New Jersey. The **Monroe Calculating Machine Co.**, West Orange, will erect a concrete and steel factory building to cost $150,000 and an addition to the plant to cost $50,000. The new building will be a block away from the main plant. The company announces sales for March and April have exceeded any two month period in the concern's 24 years in business. The new building will house the punch-press unit and will comprise 16,500 more square feet.

Following Newark concerns have been chartered: **Clinton Jewelry Co., Inc.**, $125,000; **Kolorama Laboratories, Inc.**, 500 shares, no par; **Royal Plating & Polishing Co.**, 50 shares, no par; **Chron-Art Electrical Manufacturing Corp.**, 2,500 shares, no par; **Clinton Metals Corp.**, 2,500 shares, no par; **Harco Chemical Co.**, 100 shares, no par.—**C. A. L.**

Trenton, N. J.

June 26, 1936.

Labor leaders declare that the Supreme Court decision declaring unconstitutional the minimum wage laws of the States will have little effect upon the metal industry. There are few women and children employed in metal plants in New Jersey. Leaders of the American Federation of Labor see the minority opinion of the court as a basis for their demands. **State Labor Commissioner John J. Toohey** will confer with **Attorney General Wilentz** to determine whether New Jersey's law authorizing minimum wages has been completely nullified by the decision.

The **John A. Roebling's Sons Company** had a large exhibit at the recent factory exhibition held at the Trenton Armory. The company donated some of its wire and other products as door prizes.

Following concerns have been incorporated here: **Hi-State Metalware Mfg. Co.**, East Rutherford, $50,000; **Strucolite Lamp Division, Inc.**, Troy Hills $125,000; **Camden Metal Works**, Camden, $125,000.—**C. A. L.**

Middle West

Detroit, Mich.

June 26, 1936.

This area surely seems to be settling into its usual summer run. Production in the big manufacturing plants, particularly where non-ferrous metals are concerned, is registering declines. But it is pleasing to state that conditions are nowhere nearly so pronounced as a year ago. So every one is encouraged, confidence is maintained, and it is believed that manufacturing will soon be resumed with more vigor than ever.

All the motor car plants are still busy, but, of course, are not turning out the number of cars they did earlier in the spring.

Manufacturers of refrigeration units have had another active month, with production holding to a high point. This industry has been favored over a long period.

Plating, as might be expected, is effected by the slow-up in the motor car field and conditions in this industry will register no important change until the automotive production is speeded up again. Manufacturers of motor car accessories also are under reduced schedules.

The newest development in the steady expansion program will mean that in a few months the **Pontiac Motor Co.** will be building as high a percentage of all parts used in Pontiac car manufacture as was true in the late twenties, before contracting markets began to darken buildings in the new factory on the edge of the city.

The **Continental Motors Corpn.**, of Muskegon and Detroit, announces several changes in the administrative personnel. To **William R. Angell**, president, have been added the duties of treasurer. Other changes are election of **Judge George M. Clark**, a director, as secretary, succeeding **W. Craig Keith**, resigned to become assistant secretary of the **Chrysler Corp.**; election of **B. F. Tobin, Jr.**, formerly treasurer, as vice-president in charge of sales with offices in Detroit; naming of **L. P. Kalb** as vice president in charge of manufacturing and engineering; naming of **Clarence Reese** as vice president and assistant general manager; appointment of **H. W. Vandeven**, formerly auditor, as assistant treasurer; and **C. R. Philips** as auditor.

Pacific States

Los Angeles, California

June 26, 1936.

Col. W. F. Rockwell, president of the Pittsburgh, Pa., **Equitable Meter Company**, was here in the city to arrange for the building of a branch $1,000,000 factory, for the making of valves and meters, to employ 500 hands. Mr. Rockwell also says they expect to build here another $1,000,000 plant to make axles, a branch of the **Timken-Detroit Axle Company. Walter H. Davis** is the Pacific Coast manager for the Rockwell interests.

The **Lockheed Aircraft Corporation** of Burbank, are buying nine acres there and have plans for the construction of a large new factory to have 125,000 square feet of space. They have contracts for planes on hand now amounting to $630,000.

The **Martin-Decker Company**, with **Walter R. Martin** and **Walter C. Chaffee, Jr.**, at the head, will build an airplane factory at the Municipal airport at Long Beach. **William A. Frye** is general manager.

Stephen Moosny, proprietor of the **Independent Foundry Supply Company**, have bought the property at 2325 East 38th Street and will erect a building for their own use.

Household Helps, Muncie, Ind., metal specialty manufacturers, appointed as their Pacific Coast manager, **C. W. Kingsmore** of the Transportation Building.

The **Parker Ice Machine Company** of San Bernardino, will build a new plant there. **W. K. Murphy**, general manager.

The **Wilgus Manufacturing Company** of 1726 East 26th Street, making sprinklers and gas regulators, have now started making a new line, oil burners.

The **Jadson Motor Products Company** of 8354 Wilcox Avenue, Bell, are turning out a large line of aluminum products.

The **Royal Beaty Manufacturing Company** of 111 East 7th Street, are making an electric flat iron for tailors.

The **Spear Tap Manufacturing Company** have moved to larger quarters at 324 North San Pedro Street, making couplings for garden hose.

The **O'Keefe-Merritt Company** of 3700 East 9th Street, are using natural gas for their special work in enameling, baking and japanning for the making of stoves and refrigerators.—**H. S.**

North Pacific Coast

June 26, 1936.

The **Besler Systems** of Oakland, are building the first steam engines for airplanes, trucks and buses. This plant is backed by the **Davenport (Iowa) Locomotive and Manufacturing Company. Paul Doxey** is superintendent of the Oakland plant and **Mr. Besler** the inventor.

The **Dalmo Manufacturing Company** of San Francisco, in connection with **Wm. Worth**, have designed and are making a new gas fuel burner.

S. F. Bowker Company of Fort Wayne, Ind., have increased their output of beer filtering systems. Their head office on the coast is San Francisco, at 425 Brannan Street.

The **Elkington-Helwig Company** of 621 Minna Street, San Francisco, making dish washing machines, are building a new factory.

The **Western Battery and Manufacturing Company** of Marshfield, Oregon, have built a new factory. **M. T. Van Derslice**, president.—**H. S.**

Electrolytic Production of Metallic Manganese

The first report of the Electrometallurgical Laboratory of the Bureau of Mines, Department of the Interior, soon to be issued, will disclose the development of a method for the production of metallic manganese from its ores by leaching and electrolysis. The pure metal so produced is in the form of bright, coherent sheets perfectly stable in air. The electrolyte used is manganese sulphate, since this is the most convenient form in which to obtain manganese by leaching. The secret of success is an ingenious method of maintaining an absolutely constant acidity of the electrolyte. The process is simple and cheap and adaptable to commercial utilization.

Metal Graining Patent Suit

A method of doing business in which the owner of a patent compels his licensees to buy unpatented materials for use in connection with the patent, has just been condemned by the U. S. Circuit Court of Appeals for the Sixth Circuit in an opinion recently announced.

One of the defendants in the case, the **Oxford Varnish Corporation,** was the owner of the Henry patent covering a process of making graining plates to be used by metal furniture manufacturers in simulating the color and appearance of natural wood grains. It was Oxford's practice to manufacture the plates and lease them to licensees under its patents upon a royalty basis based upon the amount of finished product produced by them. The leasing contract in effect required the licensees to buy all of the varnishes, inks, paints and lacquers used in the graining operation from Oxford, because if these unpatented materials were bought elsewhere, the patent royalty was declared to be three times the amount that it would be if the materials were purchased from Oxford. The result was that competitors of Oxford who were also in the business of furnishing ink, paints, varnishes and lacquers for use in connection with graining plates, were practically prevented from even soliciting the business of Oxford's licensees in these materials. One of these competitors, the **Ault & Wiborg Corporation,** brought a suit under provisions of the Clayton Act, to have this method of doing business declared illegal. The U. S. District Court for the Eastern District of Michigan found that the practice tended to establish a monopoly and was in restraint of trade and enjoined the performance of the contract between Oxford and its licensees. The Circuit Court of Appeals for the Sixth Circuit has just concurred in this decision.

Metal Market Review

June 26, 1936.

The **Copper** market was dull and unchanged, remaining at 9.50c per pound for electrolytic. Sales were 3,468 tons, 3,200 tons, 4,350 tons and 4,340 tons during the past four weeks. Statistics for May showed a reduction in world stocks of 6,077 tons. Domestic apparent consumption is about 60,000 tons per month. Toward the last, copper firmed up abroad and was quoted for export at 8.875c per pound f.o.b. refinery.

Zinc held at 4.90c per pound for Brass Special, f.o.b. St. Louis for the first two weeks, but weakened shortly after the middle of the month, and toward the last, the price was reduced to 4.85. Sales were 4,800 tons, 5,200 tons, about 4,000 tons and about 5,000 tons during the past four weeks. The decline was caused by weakness of the metal abroad even though statistics in the United States are excellent.

Concerning **Cadmium,** one of the important by-products of Zinc, it has been reported that some of the leading producers have sold cadmium to bearing manufacturers at 75c per pound in large quantities on contracts covering six months' requirements. Prices to the plating trade are still from 90c to $1.05.

Tin was headed downward toward the close of May and continued this trend, sliding from 44.75c per pound for Straits on May 29th, to 43 by the end of the week, and as low as 41.25 on June 18th. It rose again during the next week to 42.750. The sharp decline in London was evidently caused by the uncertainty over the future Tin Control Plan, and heavy shipments shown by May statistics from Malaya. Good buying was in evidence by the consumer market which took advantage of the decline.

A meeting of the International Tin Committee toward the last of the month was expected to determine the production quotas for the third quarter and perhaps steady the market, during that period at any rate, but the production quotas were raised to 90% and the market dropped to 40.50.

Statistics from the International Tin Research and Development Council showed that the actual absorption of primary tin into the manufacture of tin plate, babbitt, etc., in the United States during the first four months of 1936, totaled 20,310 long tons against 21,710 tons in the same period of 1935. Buyers of foreign tin took 23,990 tons for that period against 19,825 tons in 1935.

Lead was also unchanged in price, remaining unmoved at 4.45c per pound, f.o.b. St. Louis. Sales were 5,800 tons, 1,700 tons, 2,100 tons and 2,100 tons for the last four week-period; very light buying. It is estimated that shipments to consumers are moving at the rate of about 36,000 tons per month. Figures as of May 1st, showed a reduction of over 6,000 tons in the total lead stocks in the United States. It is believed that July requirements are only partially covered and that buying must come in good volume very soon.

Silver was steady as the Rock of Gibraltar at 44.75c per ounce. Speculators have dabbled with the market very little and the unchanged reports throughout the trade are "The tendency is steady."

Platinum featured the month by advancing to $35-$38 per ounce and remained strong with immediate prospects bright.

The Scrap Metal Market slowed up perceptibly. Rates for auto radiators were reduced around the beginning of June and offerings dropped. Offerings improved later, becoming moderate to fair around the middle of June, and then slowed again toward the last.

Brass and aluminum ingot bookings were quite slow for the entire four weeks, but brass ingot deliveries improved, latterly.

The combined deliveries of brass and bronze ingots and billets by the members of the Non-Ferrous Ingot Metal Institute for the month of May, 1936, amounted to a total of 5,747 tons. On June 1, unfilled orders amounted to a total of 19,288 net tons.

Average prices per pound received by its membership on Commercial Grades during the twenty-eight day period ending June 12th were:

80-10-10 (1½% Imp.)	10.838c
78% Metal	8.512c
81% Metal	8.759c
83% Metal	9.015c
85-5-5-5	9.322c
No. 1 Yellow Brass	7.603c

Wrought Metals held up very well considering that the peak of the automobile manufacturing season has passed. Brass mills in Connecticut Valley are doing well. Although employment is down slightly from May figures, it is markedly ahead of June, 1935. A Metropolitan distributor reports June business about the same as May and about 20 per cent ahead of 1935.

AVERAGE PRICES FOR METALS

	May
Copper c/lb. Duty 4 c/lb.	
Lake (del. Conn. Producers' Prices)	9.562
Electrolytic (del. Conn. Producers' Prices)	9.500
Casting (f.o.b. ref.)	9.162
Zinc (f.o.b. E. St. Louis) c/lb. Duty 1¼ c/lb.	
Prime Western (for Brass Special add 0.05)	4.900
Tin (f.o.b. N. Y.) c/lb. Duty Free, Straits	46.300
Lead (f.o.b. St. L.) c/lb. Duty 2⅛ c/lb.	4.450
Aluminum c/lb. Duty 4 c/lb.	20.500
Nickel c/lb. Duty 3 c/lb. Electrolytic 99.9%	35.00
Antimony (Ch. 99%) c/lb. Duty 2 c/lb.	13.500
Silver c/oz. Troy, Duty Free	44.869
Platinum $/oz. Troy, Duty Free.	30.00
Gold—Official U. S. Treasury Price $/oz. Troy	35.00

Metal Prices, June 26, 1936

(Import duties and taxes under U. S. Tariff Act of 1930, and Revenue Act of 1932)

NEW METALS

Copper: Lake, 9.625, Electrolytic, 9.50, Casting, 9.20. **Zinc:** Prime Western, 4.85. Brass Special, 4.95. **Tin:** Straits 40.50. **Lead:** 4.45. **Aluminum,** 19.22. **Antimony,** 13.00. **Nickel:** Shot, 36. Elec., 35.

Quicksilver: Flasks, 75 lbs., $75.00. **Bismuth,** $1.00. **Cadmium,** 75c to $1.00. **Silver,** Troy oz., official price, N. Y., July 2, 44.75c. **Gold:** Oz. Troy, Official U. S. Treasury price, June 26, $35.00. **Scrap Gold,** 6¾c. per pennyweight per karat, dealers' quotation. **Platinum,** oz. Troy, $35.00.

Duties: Copper, 4c lb.; zinc, 1¼c. lb.; tin, free, lead, 2½c. lb.; aluminum, 4c lb.; antimony, 2c. lb.; nickel, 3c. lb.; quicksilver, 25c lb.; bismuth, 7½%; cadmium, 15c. lb.; cobalt, free; silver, free; gold, free; platinum, free.

INGOT METALS AND ALLOYS

	Cents lb.	U S. Import Duty	U S. Import Tax*
No. 1 Yellow Brass	7.75	None	4c. lb.[1]
85-5-5-5	9.50	None	4c. lb.[1]
88-10-2 (June 1)	12.75	None	4c. lb.[1]
80-10-10	11.00	None	4c. lb.[1]
Manganese Bronze (60,000 t. s. min.)	9.75	None	4c. lb.[1]
Aluminum Bronze	13.75	None	4c. lb.[1]
Monel Metal Shot or Block	28	25% a. v.	None
Nickel Silver (12% Ni)	11.50	20% a. v.	4c. lb.[1]
Nickel Silver (15% Ni)	15.00	20% a. v.	4c. lb.[1]
No. 12 Aluminum	16.50-20	4c. lb.	None
Manganese Copper, Grade A (30%)	18.23	25% a. v.	3c. lb.[1]
Phosphor Copper, 10%	12-14	3c. lb.	4c. lb.[1]
Phosphor Copper, 15%	13.25-15	3c. lb.	4c. lb.[1]
Silicon Copper, 10%	18.30	45% a. v.	4c. lb.[1]
Phosphor Tin, no guarantee	49-.75	None	None
Iridium Platinum, 5%	$40.50	None	None
Iridium Platinum, 10%	$43.00	None	None

* Duty is under U. S. Tariff Act of 1930; tax under Section 60 (7) of Revenue Act of 1932.

[1] On copper content. [2] On total weight. "a. v." means ad valorem.

OLD METALS

Dealers' buying prices, wholesale quantities:	Cents lb.	Duty	U. S. Import Tax
Heavy copper and wire, mixed	7 to 7¼	Free	4c. per pound on copper content
Light copper	5.625to5.875	Free	
Heavy yellow brass	4 to 4¼	Free	
Light brass	3⅝to 3⅞	Free	
No. 1 composition	6 to 6¼	Free	
Composition turnings	6	Free	
Heavy soft lead	3.90 to 4	2⅛c.lb.	None
Old zinc	2½to 2⅝	1½c.lb.	
New zinc clips	3 to 3⅜	1½c.lb.	
Aluminum clips (new, soft)	13½to13¾	4c.lb.	
Scrap aluminum, cast	11½to11¾	4c.lb.	
Aluminum borings—turnings	6¼to 6½	4c.lb.	
No. 1 pewter	26 to 27	Free	
Electrotype	4 to 4¼	2⅛c.lb.*	
Nickel anodes	26 to 27	10%	
Nickel clips, new	33 to 35	10%	
Monel scrap	10 to 17	10%av.	

* On lead content.

Wrought Metals and Alloys

The following are net BASE PRICES per pound, to which must be added extras for size, shape, quantity, packing, etc., or discounts, as shown in manufacturers' price lists, effective since May 4, 1936. Basic quantities on most rolled or drawn brass and bronze items below are from 2,000 to 5,000 pounds; on nickel silver, from 1,000 to 2,000 pounds.

COPPER MATERIAL

	Net base per lb.	Duty*
Sheet, hot rolled	17 c.	2½c. lb.
Bare wire, soft, less than carloads	13¼c.	25% a. v.
Seamless tubing	17½c.	7c. lb.

* Each of the above subject to import tax of 4c. lb. in addition to duty, under Revenue Act of 1932.

BRASS AND BRONZE MATERIAL

	Yellow Brass	Red Brass 80%	Comm'l. Bronze	Duty	U. S. Import Tax
Sheet	15⅛c.	16 c.	16⅞	4c. lb.	4c. lb. on copper content.
Wire	15⅜c.	16¼c.	17⅛	25%	
Rod	13⅛c.	16¼c.	17	4c. lb.	
Angles, channels.	22⅞c.	24 c.	24⅝	12c. lb.	
Seamless tubing.	17⅜c.	18 c.	18⅞	8c. lb.	
Open seam tubing	22⅞c.	24 c.	24⅝	20% a.v.	

NICKEL SILVER

Net base prices per lb. (Duty 30% ad valorem.)

Sheet Metal		Wire and Rod	
10% Quality	24⅜c.	10% Quality	27 c.
15% Quality	26½c.	15% Quality	31⅜c.
18% Quality	27¾c.	18% Quality	34⅝c.

TOBIN BRONZE AND MUNTZ METAL

Net base prices per pound.	(Duty 4c. lb.; import tax 4c. lb. on copper content.)
Tobin Bronze Rod	17 c.
Muntz or Yellow Rectangular and other sheathing	18⅜c.
Muntz or Yellow Metal Rod	14½c.

ALUMINUM SHEET AND COIL

(Duty 7c. per lb.)

Aluminum sheet, 18 ga., base, ton lots, per lb.	32.80
Aluminum coils, 24 ga., base price, ton lots, per lb.	30.50

ROLLED NICKEL SHEET AND ROD

(Duty 25% ad valorem, plus 10% if cold worked.)

Net Base Prices

Cold Drawn Rods	49c.	Cold Rolled Sheet	53c.
Hot Rolled Rods	44c.	Standard Sheet	48c.

MONEL METAL SHEET AND ROD

(Duty 25% ad valorem, plus 10% if cold worked.)

Hot Rolled Rods (base)	34	Standard Sheets (base)	38
Cold Drawn Rods (base)	39	Cold Rolled Sheets (base)	43

SILVER SHEET

Rolled sterling silver (July 2) 47c. per Troy oz. upward according to quantity. (Duty, 65% ad valorem.)

ZINC AND LEAD SHEET

	Cents per lb. Net Base	Duty
Zinc sheet, carload lots, standard sizes and gauges, at mill, less 7 per cent discount	9.50	2c. lb.
Zinc sheet, 1200 lb. lots (jobbers' price)	10.25	2c. lb.
Zinc sheet, 100 lb. lots (jobbers' price)	14.25	2c. lb.
Full Lead Sheet (base price)	8.00	2⅜c. lb.
Cut Lead Sheet (base price)	8.25	2⅜c. lb.

BLOCK TIN, PEWTER AND BRITANNIA SHEET

(Duty Free)

This list applies to either block tin or No. 1 Britannia Metal Sheet, No. 23 B. & S. Gauge, 18 inches wide or less; prices are all f. o. b. mill:

500 lbs. over	15c. above N. Y. pig tin price
100 to 500 lbs.	17c. above N. Y. pig tin price
Up to 100 lbs.	25c. above N. Y. pig tin price
Up to 100 lbs.	25c. above N. Y. pig tin price

Supply Prices on page 284.

Supply Prices, June 26, 1936

ANODES

Prices, except silver, are per lb. f.o.b., shipping point, based on purchases of 500 lbs. or more, and subject to changes due to fluctuating metal markets.

Copper: Cast ..... 16½c. per lb.
Electrolytic, full size, 14½c. cut to size 14½c. per lb.
Rolled oval, straight, 15¼c.; curved 16¼c. per lb.
Brass: Cast ..... 17½c. per lb.
Zinc: Cast ..... 10⅛c. per lb.

Nickel: 90-92% ..... .45 per lb.
95-97% ..... .46 per lb.
99%+cast, 47c.; rolled, depolarized, 48.
Silver: Rolled silver anodes .999 fine were quoted July 2, from 48c. per Troy ounce upward, depending on quantity.

WHITE SPANISH FELT POLISHING WHEELS

Diameter	Thickness	Under 50 lbs.	50 to 100 lbs.	Over 100 lbs.
10-12-14 & 16	1" to 2"	$2.95/lb.	$2.65/lb.	$2.45/lb.
10-12-14 & 16	2 to 3½	2.85	2.55	2.35
6-8 & over 16	1 to 2	3.05	2.75	2.55
6-8 & over 16	2 to 3½	3.00	2.70	2.45
6 to 24	Under ½	4.25	3.95	3.75
6 to 24	½ to 1	3.95	3.65	3.45
6 to 24	Over 3½	3.35	3.05	2.85
		Any Quantity		
4 to 6	Under ½,	$5.00	½-1, $4.85	1 to 3, $4.75
1½ to 4	"	5.55	" 5.40	" 5.35
1 to ½	"	5.85	" 5.70	" 5.60

Extras: 25c per lb. on wheels, 1 to 6 in. diam., over 3 in. thick.
On grey Mexican wheels deduct 10c. per lb. from above prices.

COTTON BUFFS

Full disc open buffs, per 100 sections when purchased in lots of 100 or less are quoted:

16" 20 ply 84/92 Unbleached	$71.13
14" 20 ply 84/92 Unbleached	54.58
12" 20 ply 84/92 Unbleached	41.09
16" 20 ply 80/92 Unbleached	59.37
14" 20 ply 80/92 Unbleached	45.64
12" 20 ply 80/92 Unbleached	34.45
16" 20 ply 64/68 Unbleached	51.26
14" 20 ply 64/68 Unbleached	39.47
12" 20 ply 64/68 Unbleached	29.86

⅜" Sewed Buffs, per lb., bleached or unbleached 48c. to 1.12

CHEMICALS

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone C. P.	lb.	.09¼-14¼
Acid—Boric (Boracic) granular, 99½+% ton lots	lb.	.05¼-.04¾
Chromic, 400 or 100 lb. drums		.16¾
Hydrochloric (Muriatic) Tech., 20 deg., carboys	lb.	.03
Hydrochloric, C. P., 20 deg., carboys	lb.	.06½
Hydrofluoric, 30%, bbls.	lb.	.07-.08
Nitric, 36 deg., carboys	lb.	.05-.06¼
Nitric, 42 deg., carboys	lb.	.07-.08
Sulphuric, 66 deg., carboys	lb.	.02
Alcohol—Butyl, drums	lb.	.09½-.12
Denatured, drums	gal.	.475-.476
Alum—Lump, barrels	lb.	.03¼-.03½
Powdered, barrels	lb.	.0340-.0365
Ammonia, aqua, com'l., 26 deg., drums, carboys	lb.	.02½-.05
Ammonium—Sulphate, tech., bbls.	lb.	.03½-.05
Sulphocyanide, technical crystals, kegs	lb.	.55-.58
Arsenic, white kegs	lb.	.04½-.05
Asphaltum, powder, kegs	lb.	.23-.41
Benzol, pure, drums	gal.	.41
Borax, granular, 99½+%, ton lots	lb.	.0245-.0295
Cadmium oxide, 50 to 1,000 lbs.	lb.	1.05
Calcium Carbonate (Precipitated Chalk), U. S. P.	lb.	.05¾-.07½
Carbon Bisulphide, drums	lb.	.05½-.06
Chrome, Green, commercial, bbls.	lb.	.21½-.23½
Chromic Sulphate, drums	lb.	.33-.55
Copper—Acetate (Verdigris)	lb.	.21
Carbonate, 53/55% cu., bbls.	lb.	.15½
Cyanide (100 lb. kgs.)	lb.	.38-.40
Sulphate, tech., crystals, bbls.	lb.	4.55-5c.
Cream of Tartar Crystals (Potassium Bitartrate)	lb.	.20¼-.20½
Crocus Martis (Iron Oxide) red, tech., kegs	lb.	.07
Dextrin, yellow, kegs	lb.	.05-.08
Emery Flour	lb.	.06
Flint, powdered	ton	30.00
Fluorspar, bags	lb.	.03½
*Gold Chloride	oz.	$18¼-23
*Gold Cyanide, Potassium		$15.45
*Gold Cyanide, Sodium		$17.10
Gum—Sandarac, prime, bags	lb.	.50
Shellac, various grades and quantities	lb.	.21-.31

*Subject to fluctuations in metal prices.

Iron Sulphate (Copperas), bbls.	lb.	.016
Lead—Acetate (Sugar of Lead), bbls.	lb.	.10-.13½
Oxide (Litharge), bbls.	lb.	.12½
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.58
Methanol, (Wood Alcohol) Pure, drums	gal.	.42½
Nickel—Carbonate, dry, bbls.	lb.	.35-.41
Chloride, bbls.	lb.	.18-.22
Salts, single, 425 lb. bbls.	lb.	.13½-.14½
Salts, double, 425 lb. bbls.	lb.	.13½-.14½
Paraffin	lb.	.05-.06
Phosphorus—Duty free, according to quantity	lb.	.35-.40
Potash Caustic Electrolytic 88-92% broken, drums	lb.	.07¼-.08⅜
Potassium—Bichromate, casks (crystals)	lb.	.09
Carbonate, 96-98%	lb.	.07⅜
Cyanide, 165 lbs. cases, 94-96%	lb.	.57½
Pumice, ground, bbls.	lb.	.02½
Quartz, powdered	ton	$30.00
Rosin, bbls.	lb.	.04½
Sal Ammoniac (Ammonium Chloride) in bbls.	lb.	.05-.07½
*Silver—Chloride, dry, 100 oz. lots	oz.	.38
Cyanide, 100 oz. lots	oz.	.46-.50
Nitrate, 100 ounce lots	oz.	.32¾
Soda Ash, 58%, bbls.	lb.	.0252
Sodium—Cyanide, 96 to 98%, 100 lbs.	lb.	.17½-.22
Hyposulphite, kegs, bbls.	lb.	.03½-.06½
Metasilicate, granular, bbls.	lb.	2.80-3.30
Nitrate, tech., bbls.	lb.	.02¼
Phosphate, tribasic, tech., bbls.	lb.	.03
Silicate (Water Glass), bbls.	lb.	.01½
*Stannate, drums	lb.	.28½-.31½
Sulphocyanide, drums	lb.	.30-.45
Sulphur (Brimstone), bbls.	lb.	.02
*Tin Chloride, 100 lb. kegs	lb.	.36
Tripoli, powdered	lb.	.03
Trisodium Phosphate—see Sodium Phosphate.		
Wax—Bees, white, ref. bleached	lb.	.60
Yellow, No. 1	lb.	.45
Whiting, Bolted	lb.	.02½-.06
Zinc—Carbonate, bbls.	lb.	.11-.12
Cyanide (100 lb. kegs)	lb.	.37-.38
Chloride, drums, bbls.	lb.	.06
Sulphate, bbls.	lb.	.028-.037